20-28

Kishoreganj University

1st Year 1st Semester B. Sc. (Engg.) Final Examination-2024

Department of Computer Science and Engineering

CSE 1101: Computer Fundamentals (3 Credits)

Time: 3 Hours **Full Marks: 70**

Figures shown in the right margin indicate full marks.
Answer 05 out of 07 questions.

1	**a.**	Define computer. Draw a block diagram showing all functional units of a digital computer and explain the function of each unit in brief.	5
	b.	Discuss the characteristics of 4th and 5th generation computers.	3
	c.	Why is the BIOS stored in ROM and not in RAM? Justify your answer.	3
	d.	Suppose you are assigned to construct a network with 55 connection lines using the concept of fully connected mesh topology. Calculate how many nodes will be able to communicate with such a network.	3
2	**a.**	What do you mean by system boot up? Briefly discuss the PC's booting up process.	3
	b.	What is the purpose of the motherboard in a computer system? List and briefly explain the major components found on a motherboard.	4
	c.	Explain three key differences between system software and application software. Also identify three examples of application software that can enhance teaching in the classroom.	4
	d.	Write short notes on any three of the following: (i) MAC address (ii) DNS (iii) URL (iv) Port	3
3	**a.**	Define computer networks. What are the types of computer networks based on size and purpose?	3
	b.	Explain the use of basic network tools like ping and traceroute in troubleshooting network issues.	3
	c.	Given the IP address 192.168.10.50/28, calculate the following: (i) Address class (ii) Subnet mask in binary and dotted decimal (iii) Network address (iv) Broadcast address (v) First usable host address (vi) Last usable host address (vii) Number of usable host addresses	4
	d.	Describe the OSI model. What is the difference between IPv4 and IPv6?	4

4 a. Identify the output of the following program and explain the reasons of such output. 4

```
#include<stdio.h>
int main()
{
  int a=1;
  do
  {
    if (a==c) break;
    printf("%d ", a);
    a++;
  }while(a <= 100);
  return 0;
}
```

b. Write a C program that takes a positive integer n as user input and calculates the **factorial** of that number. 5

Sample Input	Sample Output
Enter a number: 5	The factorial of 5 is: 120

c. Write a C program that takes integer as user input and display a pattern like a **right-angle triangle** using an asterisk. 5

Sample Input	Sample Output
Input the number: 3	* ** ***

5 a. Define algorithm. What are the essential properties of an algorithm? 3

b. Write a program that will read the value of x and evaluate the following function using conditional operator. 4

$$y = \begin{cases} 1 \text{ for } x > 0 \\ 0 \text{ for } x = 0 \\ -1 \text{ for } x < 0 \end{cases}$$

c. A program in C contains the following declaration and initial assignments: 4

```
int i = 8, j = 5, k;
float z;
char a, b, c = 'c', d = 'd';
```

Determine the value of each of the following expression:

(i) $z = i / j$
(ii) i += (j-2)
(iii) $k = j>5 \ ? i : j$
(iv) $a = c<d \ ? c : d$

d. Determine which of the followings are valid or invalid identifiers (Mention proper reason) 3

wv, $abc, Tx7, g h, 4y, const

6 **a.** Perform the following operations (show all the necessary steps): 3

(i) Convert $(67512)_8$ to $(?)_2$

(ii) Convert $(10111101110)_2$ to $(?)_{16}$

(iii) Convert $(1ABAB)_{16}$ to $(?)_8$

b. Find the subtraction of $(22C)_{16}$ and $(5D)_{16}$. Perform left logical shift operations and right arithmetic shift operations on the binary number 1101011111 by three bits. **3**

c. Perform the following operations (show all the necessary steps): **4**

(i) Subtract 101101_2 from 111101_2 using complementary method

(ii) Divide 11010110_2 by 101_2

d. Write binary coding for the word **KIU** in ASCII-8. Calculate the number of bytes required for this representation. **4**

7 **a.** Name three network devices from the physical, data link, and network layers. Also make a comparison among those. **4**

b. A computer has a 500 GB hard disk. If 200 GB is already used, what percentage of the disk is free? Show your calculations. **2**

c. Write down the difference between algorithm and flowchart. **3**

d. List and explain five terminologies used in word processing package like MS Word. **5**

Kishoreganj University

1st Year 1st Semester B. Sc. (Engg.) Final Examination-2024

Department of Computer Science and Engineering

CSE 1103: Discrete Mathematics (3 Credits)

Figures shown in the right margin indicate full marks.
Answer 05 out of 07 questions.

1. **a.** A secure vault system assigns a unique 4-digit access code to each authorized user. To enhance security, each access code must include at least one odd digit and at least two even digits. How many different access codes can be generated under these constraints? **4**

   b. A delivery drone is programmed to drop off packages at 9 different locations. It must start from a designated hub, but it can visit the remaining 8 delivery points in any order. How many different routes can the drone take to complete its deliveries? **4**

   c. A game designer has 11 skill points to distribute among three player attributes: Speed, Strength, and Defense. The points can be assigned in any way, including giving zero points to an attribute. How many different ways can the designer distribute the 11 skill points? **6**

2. **a.** Explain Universal Quantifier and Existential Quantifier with proper examples. Translate these specifications into English where $F(p)$ is "Printer p is out of service," $B(p)$ is "Printer p is busy," $L(j)$ is "Print job j is lost," and $Q(j)$ is "Print job j is queued." **6**

   i) $\exists p(F(p) \wedge B(p)) \rightarrow \exists j L(j)$

   ii) $\forall p B(p) \rightarrow \exists j Q(j)$

   iii) $\exists j(Q(j) \wedge L(j)) \rightarrow \exists p F(p)$

   iv) $(\forall p B(p) \wedge \forall j Q(j)) \rightarrow \exists j L(j)$

   b. Freedonia has fifty senators. Each senator is either honest or corrupt. Suppose you know that at least one of the Freedonian senators is honest and that, given any two Freedonian senators, at least one is corrupt. Based on these facts, can you determine how many Freedonian senators are honest and how many are corrupt? If so, what is the answer? **4**

   c. For each of these arguments, explain which rules of inference are used for each step. **4**

   i) "Doug, a student in this class, knows how to write programs in JAVA. Everyone who knows how to write programs in JAVA can get a high-paying job. Therefore, someone in this class can get a high-paying job."

   ii) "Somebody in this class enjoys whale watching. Every person who enjoys whale watching cares about ocean pollution. Therefore, there is a person in this class who cares about ocean pollution."

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3. **a.** A faulty sensor in a data center transmits signals where 90% of the time it sends a low signal (0) and 10% of the time it sends a high signal (1). Each signal is sent independently. If the sensor transmits 10 signals, what is the probability that exactly 8 of them are low signals (0)? **4**

b. At a space station, two energy cores are activated, each displaying a random power level between 1 and 8. The spaceship requires a precise energy level of 12 to successfully initiate its launch sequence. If the combined energy output of the two cores equals 12, the spaceship can take off; otherwise, the launch is aborted. What is the probability that the energy cores generate exactly 12, allowing the spaceship to launch? **4**

c. Two treasure chests contain a mix of gold and silver coins. The first chest holds 2 gold coins and 7 silver coins, while the second chest contains 4 gold coins and 3 silver coins. A pirate randomly chooses one of the chests and then picks a coin at random. If the pirate pulls out a silver coin, what is the probability that it came from the first chest? **6**

4. **a.** Determine whether the function f from {a, b, c, e} to {1, 2, 3, 4, 6} with f(a) = 4, f(b) = 5, f(c) = 1, and f(e) = 3 is one-to-one. **4**

b. Let f: $Z \rightarrow Z$ be such that $f(x) = x + 1$. Is f invertible? If it is, what is its inverse? **4**

c. Let g be the function from the set {a, b, c} to itself such that g(a) = b, g(b) = c, and g(c) = a. Let f be the function from the set {a, b, c} to the set {1, 2, 3} such that f(a) = 3, f(b) = 2, and f(c) = 1. What is the composition of f and g? What is the composition of g and f? **6**

5. **a.** Is this argument logically valid? "If you successfully bypass every security layer, you will gain access to the secret database. You gained access to the secret database. Therefore, you must have bypassed every security layer." **4**

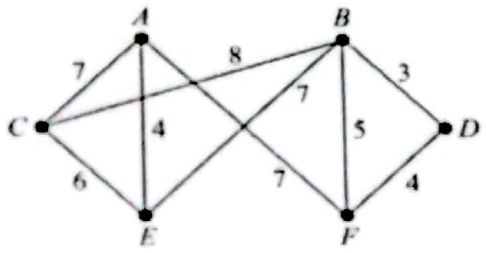
b. Using rules of inference, show that the premises "At least one soldier in the battalion has not received combat training." and "Every soldier in the battalion survived the battle." imply the conclusion: "Someone who survived the battle had not received combat training." **4**

c. Determine the contrapositive, converse, and inverse of this conditional statement: "The security system activates whenever an unauthorized person enters the restricted zone." **6**

6. **a.** Find a minimum spanning tree for the given weighted graph using: **6**

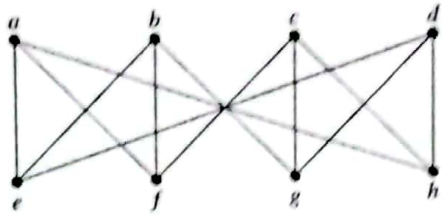
i) Prim's algorithm

ii) Kruskal's algorithm

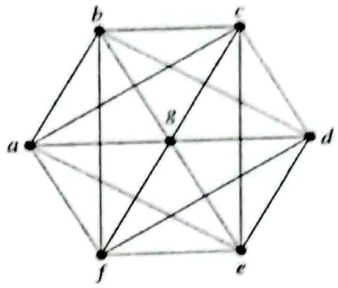


b. Use Kuratowski's theorem to determine whether the given graph is planar or not. 4

i)

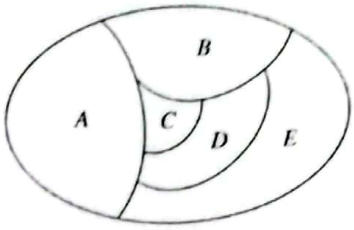


ii)

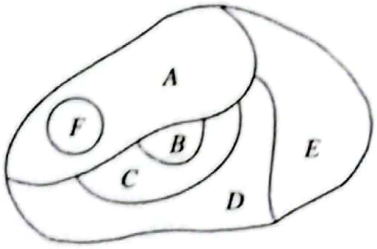


c. Construct the dual graph for the map shown. Then find the number of colors needed to color the map so that no two adjacent regions have the same color. 4

i)



ii)



7. A cybersecurity research lab is developing a new intrusion detection system (IDS) for protecting cloud servers from cyberattacks. The team consists of security analysts, ethical hackers, and AI specialists. They are working on assigning tasks, analyzing cyber threats, and defining security protocols for the system to ensure maximum protection against unauthorized access.

a. The lab has 6 security analysts, but only 3 of them can be assigned to monitor real-time network traffic. If the order of assignment does not matter, in how many ways can the team select the 3 analysts? **4**

b. The research team has established two security protocols: "Every file transfer exceeding 1 MB must undergo an integrity check before reaching its destination." Additionally, "If a user requests access to a critical system, at least one multi-factor authentication step must be completed." Use predicates and quantifiers to express these security system specifications. **4**

c. The research team models a cloud security system as a graph, where servers are nodes and direct connections are edges. The system has 8 servers, each connected to every other, forming a fully connected network. Due to security concerns, the team needs to identify critical servers whose failure would disconnect parts of the network. In graph theory, these are known as articulation points, nodes whose removal increases the number of connected components in the graph. **6**

i) How many total connections (edges) exist in this network of 8 servers?

ii) If a specific server is identified as an articulation point, what does that imply about the network's structure?

iii) Does this network mentioned above have any articulation points? Why or why not?

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1st Year 1st Semester B. Sc. (Engg.) Final Examination-2024

Department of Computer Science and Engineering

PHY 1105: Physics (3 Credits)

Figures shown in the right margin indicate full marks.
Answer 05 out of 07 questions.

1 **a.** State the 1st law of thermodynamics. Explain graphically the relation between heat and work. **4**

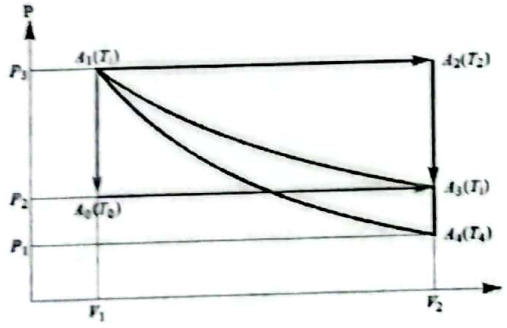
b. An ideal gas is initially at the volume V_i, Pressure P_i, and temperature T_i. The gas is expanded isothermally to a new volume V_f, Pressure P_f. Calculate the amount of work done for this process. **5**

c. Suppose we have 2 moles of an ideal polyatomic gas initially with a volume of 2 m^3, and a temperature of 273 K. This gas is compressed isothermally to 1/2 its initial volume. How much heat must be added to the system during this compression? Given, the value of molar gas constant is 8.314 J/(mol·K). **5**

2 **a.** State the Kelvin's and Clausius formulation of second law of thermodynamics. **4**

b. What are the differences between reversible and irreversible processes? **3**

c. Calculate the entropy changes along all the four paths of a reversible process as represented by the diagram below. Path-1: $A_1 \rightarrow A_3$ isothermal denoted by red, path-2: $A_1 \rightarrow A_4 \rightarrow A_3$ partly adiabatic denoted by blue, path-3: $A_1 \rightarrow A_0 \rightarrow A_3$ denoted by green, and path-4: $A_1 \rightarrow A_2 \rightarrow A_3$ denoted by purple. **7**



3 **a.** Calculate the packing fraction of the BCC and HCP lattice. **3**

b. Define Miller Indices. Write down the rule for writing the Miller Indices. Draw the (110) and $(1\bar{1}1)$ crystal planes. **2+3**

c. Write down the postulates of free electron theory of solids. From free electron theory show that the conductivity of metal can be written as $\sigma = \frac{ne^2 t_r}{m}$ where the symbols have their usual meanings. **3+3**

4 a. What are the different types of dislocations characterized by the Burgers vector? 3

b. Explain with appropriate diagram and equation, what happens if the phase difference between the harmonic oscillations are: $\varphi = \frac{\pi}{4}$, $\varphi = \frac{\pi}{2}$, $\varphi = 0$, and $\varphi = \pi$. 8

c. What are the Miller indices for a vector that passes from point $\frac{1}{4}$, 0, $\frac{1}{2}$ to point $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{2}$ in a cubic unit cell? 3

5 a. Define simple harmonic motion. Show that the energy of a simple harmonic motion is conserved. 1+3

b. Write down the differential equation of a simple harmonic motion. Show that the solution of the equation can be written as $y = asin(\omega t + \varphi)$,where the symbols have their usual meanings. 1+5

c. In an experiment with Newton's Rings, the diameters of the 4th and 12th dark rings are measured to be 2.0 mm and 4.5 mm respectively. If the radius of curvature of the lens is 1.5 m, find the wavelength of light used. 4

6 a. What is damped harmonic motion? Write down the differential equation of damped harmonic motion. 2

b. Explain the solution of damped harmonic motion for the case of under, over, and critical damping conditions. 8

c. For a damped oscillator with mass m=250 g, k=85 N/m, and b= 70 g/s. 4

i) How long does it take for the amplitude of the damped oscillations to drop to half its initial value?

ii) How long does it take for the mechanical energy to drop to one-half its initial value?

7 a. Define normal mode and normal coordinate. 2

b. Consider two massless rods of length l, which have bobs of mass m attached to the end, which are themselves connected by a spring. Write down the differential equations of the motion. 2

c. Solve the above differential equations to find out the normal modes of oscillation. Explain each mode interms of the initial conditions. 7+3

Kishoreganj University

1st Year 1st Semester B.Sc. (Engg.) Final Examination-2024
Department of Computer Science and Engineering
MAT 1107: Calculus (3 Credits)

Time: 03:00 Hours **Full Marks: 70**

Answer any five (05) questions. Numbers given in the right margin indicate the marks of the respective questions.

1. (a) Define a function. Sketch the graph of the function defined piecewise by the formula: [3]

$$f(x) = \begin{cases} 0, & \text{if } x \leq -1 \\ \sqrt{1-x^2}, & \text{if } -1 < x < 1 \\ x, & \text{if } x \geq 1 \end{cases}$$

(b) Show that the domain of $f(x) = log\frac{1-x}{1+x}$ is $-1 < x < 1$. Also, show that for $x_1, x_2 \in (-1,1)$, $f(x_1) + f(x_2) = f(\frac{x_1+x_2}{1+x_1 \cdot x_2})$. [4]

(c) Define one-one and onto function. When a function is said to be invertible? Let $f : \mathbb{R} \to \mathbb{R}$ be defined by $f(x) = 2x - 3$. Now f is one-one and onto; hence f has an inverse function f^{-1}. Find a formula for f^{-1} and hence determine the value of $f^{-1}(3)$. [7]

2. (a) Define $\delta - \epsilon$ definition of a limit at a point x_0. Show that, $\lim_{x\to 1}(5x - 3) = 2$ by $\delta - \epsilon$ definition of a limit. [4]

(b) State Sandwich theorem for limit. Prove that, $\lim_{x\to 0} \frac{sinx}{x} = 1$, by sandwich theorem. [5]

(c) Compute the following limits: [2+3]

$$(i) \quad \lim_{x\to 0} \frac{x^2 sin(\frac{1}{x})}{sinx}$$

$$(ii) \quad \lim_{x\to 0} (\frac{tanx}{x})^{\frac{1}{x}}.$$

3. (a) Define continuity and differentiability of a function at a point. If [6]

$$f(x) = \begin{cases} 2 - x, & \text{if } 1 \leq x \leq 2 \\ x - \frac{x^2}{2}, & \text{if } x > 2 \end{cases}$$

Show that, $f(x)$ is continuous and differentiable at $x = 2$.

(b) If a function f is differentiable at x_0, then f is continuous at x_0. [4]

(c) Find the differential coefficient of $(tanx)^{cotx} + (cotx)^{tanx}$. [4]

4. (a) The volume of a spherical ballon is increasing at the rate of 12 cm^3/sec. Find the rate of change of its surface at the instant when its radius is 6 cm. [4]

(b) Determine the extremum of $f(x) = 5x^6 - 18x^5 + 15x^4 - 10$. [10]

5. (a) Compute the following integral by partial fraction: $\int \frac{dx}{(x^3+1)}$. [5]

(b) State Mean Value theorem for definite integrals. Verify it for $f(x) = x^2$ on the interval $[1, 4]$. [4]

(c) Define improper integrals. Evaluate: $\int_0^3 \frac{dx}{(x-1)^{\frac{2}{3}}}$. [5]

6. (a) Determine [6]

$$(i) \int \frac{\sin 2x}{(a + b\cos x)^2} dx$$

$$(ii) \int_a^b \frac{dx}{x\sqrt{x-a}\sqrt{b-x}}$$

(b) Find the average value of the function $f(x) = 8 - 2x$ over the interval $[0, 4]$ and find c such that $f(c)$ equals the average value of the function over $[0, 4]$. [4]

(c) Using the fundamental theorem of calculus or otherwise evaluate [4]

$$(i) \frac{d}{dx}\left(\int_a^x \ln(sin^2(t+1))dt\right)$$

$$(ii) \int_a^x \frac{d}{dt}\left(\sqrt{1+t^2}\right) dt$$

7. (a) Find the area of the region in the first quadrant that is bounded above by $y = \sqrt{x}$ and below by the $x-$ axis and the line $y = x - 2$. [5]

(b) Define a cylindrical shell. Find a formula for calculating its volume. [3]

(c) Write the shell formula for revolution about the $x-$ axis. Use cylindrical shells to find the volume of the solid generated when the region R under $y = x^2$ over the interval $[0, 2]$ is revolved about the line $y = -1$. [6]

Kishoreganj University
1st Year 1st Semester B.Sc. (Engg.) Final Examination-2024
Department of Computer Science and Engineering
ENG 1109: English (3 Credits)

Time: 3 Hours **Full Marks: 70**

Instructions

- Figures shown in the right margin indicate full marks.
- Answer 5 out of 7 questions.

Question-1 Read the passage carefully and answer questions that follow:

If we think about what defines a country, it can feel challenging to articulate. However, the identity of a country is not unlike the identity of a person; it thrives when rooted in authenticity. Often, the strongest elements emerge when we remain true to our inner selves, and this authenticity is the most genuine manifestation of who we are.

Good schools and effective leaders analyse individual and collective traits to chart a path forward. In the same way, as a nation, we must evaluate our distinct strengths. Despite corruption and the erosion of ideals over the past 40 years, Bangladesh possesses remarkable positives amid the negatives, and one of our greatest assets is our language.

We are a culturally and literarily rich nation. Few nations have their own language, and even fewer have a language that serves as both a spoken and literary medium. Civilisations that created languages often produced significant literature, and we are no exception. Bengali, primarily spoken in this region, symbolises the creativity of our civilisation and its rich literary tradition.

Language reflects cultural depth. Consider French, renowned for its poetry and influence in fashion, or Italian and German, which have left lasting marks on art and music. English, with luminaries like Shakespeare, also exemplifies this connection. Similarly, our cultural legacy includes figures like Rabindranath Tagore and Lalon Shah. These icons remind us that we are a nation steeped in poetry, music, and literature. This cultural richness, expressed through our language and literature, is something we should cherish and take immense pride in.

Resilience is another defining characteristic of Bangladesh. Regardless of the challenges, the nation perseveres. Amid global instability, whether environmental or socio-economic, the resilience of our nation is particularly striking. On the political front, the people of this region have shown strength in the 1952 Language Movement, the 1969 Mass Uprising, the 1971 Liberation War, the 1990's anti-dictator movement, and now again with the 2024 mass uprising. During the Covid pandemic, despite dire predictions, Bangladesh managed the crisis effectively. From being labelled a "bottomless basket" to becoming a consistently performing nation, this resilience permeates every sector of society. This quality fosters trust, signalling stability at both the macro and micro levels.

Our identity as a moderate Muslim nation is another cornerstone of our character. Historically, Bangladesh has exemplified moderation and integration. Despite external narratives, particularly from neighboring countries like India, attempting to portray us as intolerant, we remain a well-integrated society exemplifying harmony and unity. This identity of moderation and cultural

richness serves as another pillar of our national stability and strength.

Over the years, we have focused on branding ourselves as an emerging tiger, a growing economy. However, these traits are not unique to us. Many other nations have shared similar trajectories, and some are no longer classified as growing economies. For example, Vietnam has developed a robust RMG sector and gained significant global recognition. How, then, should Bangladesh present itself and build its brand? The primary focus should be on its language-the heart of its identity.

The very name "Bangladesh" derives from "Bangla." This integral aspect of national identity remains underleveraged. Historically, regions or cultures that originated languages have been leaders, representing advanced civilisations. Literature signifies an intellectually rich society, and Bengali is no exception. The 1952 Language Movement, where the people of this land shed blood to preserve their mother tongue, remains a rare and unparalleled example in history. Bengali is also the fourth most spoken language globally, a significant element of our identity, and we must emphasise it and take immense pride in it.

Another key aspect of Brand Bangladesh lies in its ability to hold a moderate Muslim identity without excluding other groups. Unlike some nations plagued by communal strife, Bangladesh enjoys harmony. There is no preferential treatment or segregation; all citizens live in unity, celebrating religious festivals together. This aspect needs particular care now due to the increasingly frequent disinformation and propaganda by some groups with malevolent intentions.

Finally, Bangladesh has repeatedly proven to be a nation of resilience. From the Bengal famine to the Language Movement, from being labelled a "bottomless basket" to enduring countless national calamities-the people of this region are built to overcome adversity. We do not give up.

The world is increasingly looking for stories that inspire and resonate on a human level. This resilience is why Bangladesh is a reliable partner. Brand Bangladesh is not just about telling our story; it's about living it. By valuing our language, celebrating our resilience, and upholding our unity, we can project a vision of Bangladesh that fosters pride and possibility for ourselves and for generations to come.

a. Write answers to the following questions: 1x2=2
   i. How does language contribute to Bangladesh's cultural and literary richness?
   ii. What historical events showcase Bangladesh's political resilience?

b. Write down the main idea and four supporting ideas in this passage. 3

c. Write down the meaning of the following words and make sentences of your own: 5

   Authenticity, resilience, moderation, adversity, evaluate

d. Write a summary of the passage. 4

Question-2 Write a paragraph on the following: 7x2=14

a. The Caretaker Government

b. Pros and Cons of Using Artificial Intelligence in Education

Question-3 Fill in the blanks with appropriate prepositions: 1x14=14

a. He entered — the compartment.

b. She leans — the wall.

c. He is — casual leave now.

d. Please do not take offense — me.

e. There were only three people — board.

f. We lost our way — the restaurant.

g. She raised a complaint — me.

h. There can be no justification — this act.

i. I have no interest — politics.

j. He brings disgrace — the nation.

k. She is blind — her son's fault.

l. The library is opposite — the university.

m She is worthy — the award

n. She is an heir — this property.

Question-4: Fill in the blanks with the correct form of the verb within the brackets 1x14=14

a. If he left already, he _____ (call) us.

b. We wish that we _____ (have) more time last night.

c. I hope that they _____ (come) tomorrow.

d. He acts as if he _____ (be) rich.

e. If I have the money, I _____ (buy) a car.

f. If today were Friday, we _____ (can) go to the beach.

g. If I had watched the movie, I _____ (tell) you about it yesterday.

h. John usually _____ (walk) to school if he has enough time.

i. If you _____ (meet) Mary today, please ask her to meet me.

j. He would understand it if you _____ (explain) it to him slowly.

k. If I finish the dress tonight, I _____ (give) it to my sister for her birthday.

l. Jeff looked as if he _____ (see) a ghost.

m. Had she found the right buyer, she _____ (sell) her house.

n. My dog always wakes me up if he _____ (hear) strange noises.

Question-5 Write on the following: 7x2=14

a. Write a letter to the editor of a newspaper regarding the increase of anti-social activities in your locality.

b. Write a letter to your friend describing your experience at the University.

Question-6 Write on the following: 7x2=14

a. Suppose, you are Hanif/Rekha. Write an application to the proper authority for opening a canteen at your university

b. Suppose, you want to apply for the post of Data Analyst in a reputed IT firm. Prepare a detailed CV so that you can apply for such a position.

Question-7 Write an email on the following: 7x2=14

a. Write an email to a faculty member requesting a Letter of Recommendation.

b. Suppose, your name is Nahid/Nahida. You ordered a Bluetooth speaker from an online shop a week ago. It has not arrived yet. Now, write an email to the customer care service of the shop complaining about the delayed delivery of the ordered product.