

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science and Engineering

Final Examination-2024

Course No: CHE 0531 1201

Time: 02 (Two) hours

1st Year 2nd Semester

Course Title: Chemistry

Full Marks: 60

N.B. : (i) Use separate answer scripts for each PART

(ii) Marks allotted are indicated in the margin

(iii) Special Instruction (if any)-----N/A-----

Part A

1. a) Define quantum numbers. How are the electrons distributed in various sub-shells for $n=3$? Give the quantum numbers for the electron in the first sub-shell appearing in $n=3$ shell. 1+4
- b) State the postulates of Bohr's theory for the Hydrogen atom that successfully explains the appearance of an emission spectrum. 04
- c) Be and N in the 2nd period and Mg and P in the 3rd period of the periodic table have slightly higher ionisation energies than expected-Explain. 06
2. a) Discuss the phase diagram of sulphur. 05
- b) Describe the magnetic properties of O_2 and O_2^{2-} according to molecular orbital theory. 06
- c) At 444°C temperature, when 4.25 mole PCl_3 and 4.85 mole Cl_2 are heated in a flask of 1L, then 6.85 mol PCl_5 is produced. Calculate the value of K_c and K_p for the reaction: 04
- $$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

OR

- 2.a) Derive a relationship between K_p and K_c for the reaction: 05
- $$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$
- b) Draw molecular orbital energy level diagram for CO and find its bond order. 4+2
- c) The solubility of pure oxygen in water at 20°C and 1 atmosphere pressure is 1.38×10^{-3} mole/litre. Calculate the concentration of oxygen at 20°C and partial pressure of 0.12 atmosphere. 04

Part B

- 3.a) Explain electrolysis of aqueous NaCl. 05
- b) The S_N^1 reaction shows 50% retention and 50% inversion, whereas the S_N^2 reaction shows 100% inversion-Explain. 05
- c) Complete the following reaction with mechanism: 05
- $$C_6H_6 + CH_3I \xrightarrow[\text{AlCl}_3]{\text{anhydrous}}$$
- 4.a) State Hess's law of constant heat summation. 05
- b) What is VSEPR theory? Predict the shape of CH_4 , NH_3 , H_2O , PCl_5 and XeF_6 based on VSEPR theory. 06
- c) Calculate the concentration of sodium formate, $HCOONa$, that must be present in a 0.1 M solution of formic acid to produce a pH of 3.80. $K_a = 1.8 \times 10^{-4}$ 04

OR

- 4.a) Prove that $\Delta H = \Delta E + \Delta nRT$. 05
- b) Suppose that for the analysis purpose, you need a solution of constant pH. How can you maintain the stability of pH. 06
- c) At 25°C half-life of the reduction of N_2O_5 is 3400 minutes. Find out- i) The relative rate constant of the reaction and ii) Time that will be required for completion of 99% of the reaction. 04

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science and Engineering

Final Examination-2024
Course No: MAT 0541 1203
Time: 03 (Three) hours

1st Year 2nd Semester
Course Title: Calculus
Full Marks: 60

N.B. : (i) Use separate answer scripts for each PART
 (iii) Special Instruction (if any)-----N/A-----

(ii) Marks allotted are indicated in the margin

Part A

1. a) Find the domain and range of the function $f(x) = \frac{1}{\sqrt{x^2-4}}$ 04
- b) Find nth derivative of y where $y=(ax + b)^m$. 03
- c) If $y=(\cos^{-1}x)^2$ then prove that $(1-x^2)y_{n+2} - (2n + 1)xy_{n+1} - y_n = 0$ 03
2. a) Expand $\sin x$ in powers of x in infinite series by using Maclaurin's theorem. 05
- b) Find minimum and maximum value of $\frac{(x+1)(x+4)}{(x-1)(x-4)}$ 05

OR

2. a) Explain graphical representation of Mean value theorem. 03
- b) Verify Rolle's theorem for the function $f(x)=(x - 2)(x - 3)(x - 4)$ in the interval $[2, 3]$. 04
- c) If $u = \ln(x^3 + y^3 + z^3 - 3xyz)$ then find the value of $(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z})u$ 03
3. a) Prove that the differential equation of all parabolas whose axes are parallel to y-axis is $\frac{d^3y}{d^3x} = 0$ and draw the parabola. 3+1
- b) Define exact differential equation and solve $:(e^y + 1)\cos x dx + e^y \sin x dy = 0$ 1+2
- c) Solve: $\frac{dy}{dx} + y = y^2 e^x$. 03

Part B

4. a) Solve: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 3y = \cos x + x^2$ 05
- b) Solve initial value problem : $y'' - y' - 2y = e^{3x}$, $y(1)=2$, $y'(1)=1$ 05
5. Evaluate: (a) $\int \frac{2x^2-1}{(x+1)^2(x-2)} dx$ (b) $\int_0^\pi \frac{x dx}{a^2 - \cos^2 x}$ (c) $\int_0^{\frac{\pi}{2}} \frac{dx}{5+4\sin x}$ 4+3+3

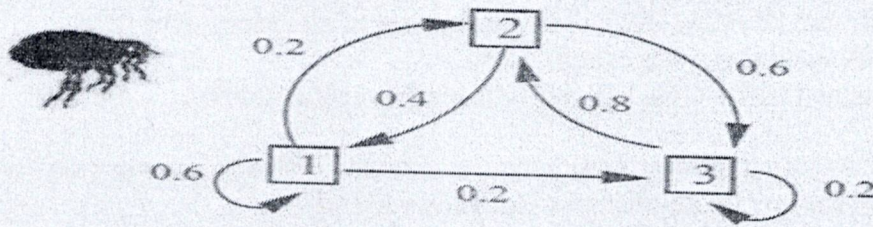
OR

5. a) Evaluate by the definition of a definite integral $\int_a^b e^x dx$ 02
- b) Find the reduction formula for $\int x^n e^{ax} dx$ and using this evaluate $\int x^3 e^{ax} dx$ 04
- c) Evaluate: (i) $\int_0^\infty \frac{x dx}{x^4+1}$ (ii) $\int_0^\infty x e^{-x^2} dx = \frac{1}{2}$ 04
6. a) Find the area of a common portion bounded by the two region $r=a(1+\cos\theta)$ and $r = a(1-\cos\theta)$. 05
- b) Solve $(D^2 + 4D + 4)y = 3e^{-x}$ where $y(0) = 3$ and $y'(0) = 1$. 05

4. (a) Prove that the language $L = \{a^n b^n c^n \mid n \geq 0\}$ is not a context free language using the Pumping Lemma. 07
- (b) Construct an NFA with regular expression case for these two Regular expressions $(a|b)^*bab$ and $(a^* \cup b^*)^*$. 08

OR

4. (a) Define the term "Turing Machine". Explain all the tuples of a Turing Machine. 03
- (b) Generate a Pseudo-Random number using congruential methods where the values of $m = 9$, $a = 7$, $c = 4$, and $x_0 = 3$. 04
- (c) Purpose-flea zooms around the vertices of the transition diagram opposite. Let X_t be Purpose-flea's state at time t ($t = 0, 1, \dots$). 08



- I. Find the transition matrix, P .
- II. Find $P(X_2 = 3 \mid X_0 = 1)$.
- III. Suppose that Purpose-flea is equally likely to start on any vertex at time 0. Find the probability distribution of X_1 .
- IV. Suppose that Purpose-flea begins at vertex 1 at time 0. Find the probability distribution of X_2 .
- V. Suppose that Purpose-flea is equally likely to start on any vertex at time 0. Find the probability of obtaining the trajectory $(3, 2, 1, 1, 3)$.

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science and Engineering

Final Examination-2024

Course No: ENG 0231 1201

Time: 02 (Two) hours

1st Year 2nd Semester

Course Title: English Language

Full Marks: 60

N.B. : (i) Use separate answer scripts for each PART

(ii) Marks allotted are indicated in the margin

(iii) Special Instruction (if any)-----N/A-----

Part A

1. a) **Read the following passage and answer the questions below.**

Motivation is the driving force that pushes individuals to pursue and achieve their goals. It plays a crucial role in personal and professional development, influencing the way people think, feel, and behave. Without motivation, even the most capable individuals may struggle to accomplish their tasks or reach their full potential. There are two primary types of motivation: intrinsic and extrinsic. Intrinsic motivation comes from within the individual. It is driven by personal satisfaction, curiosity, or a sense of accomplishment. For example, a student who studies because they genuinely enjoy learning is intrinsically motivated. Such individuals tend to be more creative, persistent, and engaged in their tasks, as their motivation is tied to their internal desire for personal growth.

On the other hand, extrinsic motivation is influenced by external factors, such as rewards or recognition. A common example is an employee who works hard to receive a promotion or a student who studies to earn high grades. While extrinsic motivation can be effective in the short term, it may not always sustain long-term engagement, as it is dependent on external rewards or approval.

Research has shown that the most successful individuals are often those who are intrinsically motivated. However, in many situations, a combination of both intrinsic and extrinsic motivation can lead to optimal results. For instance, a student may be motivated to study both because they enjoy the subject (intrinsic) and because they want to win an academic award (extrinsic).

Self-determination theory (SDT), a popular framework in motivation psychology, suggests that people are most motivated when their basic psychological needs are met. These needs include autonomy, competence, and relatedness. When individuals feel they have control over their actions (autonomy), believe they are capable of succeeding (competence), and feel connected to others (relatedness), their motivation naturally increases.

In the context of education and the workplace, understanding motivation is key to fostering productivity and success. Teachers, employers, and leaders must strive to create environments where individuals feel both intrinsically and extrinsically motivated. Recognizing and nurturing an individual's internal drive, while also providing external rewards or encouragement, can lead to higher engagement, better performance, and overall satisfaction.

Ultimately, motivation is not just about achieving goals. It is about finding purpose in the process of striving towards them. Whether the source of motivation is internal or external, it has the power to unlock a person's potential, allowing them to reach new heights of success and fulfillment.

1. a) Identify True/ False/ Not Given from the passage.

5×2=
10

- i. Intrinsic motivation is influenced by external rewards and recognition.
- ii. Self-determination theory suggests that autonomy, competence, and relatedness are essential for motivation.
- iii. Extrinsic motivation is more effective than intrinsic motivation in the long term.
- iv. Research indicates that a combination of both intrinsic and extrinsic motivation can yield the best results.
- v. The passage states that motivation levels are the same for all individuals regardless of their environment.

b) Based on your reading of the passage choose the correct option from A, B, C and D.

05

- i) What drives intrinsic motivation?
 - A. External rewards
 - B. Personal satisfaction and enjoyment
 - C. Money
 - D. Recognition
- ii) Which of the following is an example of extrinsic motivation?
 - A. Studying because you love the subject
 - B. Painting for fun
 - C. Working to earn a promotion
 - D. Playing a sport for personal growth

- iii) Which need is NOT part of Self-Determination Theory (SDT)?
 - A. Autonomy
 - B. Competence
 - C. Relatedness
 - D. Wealth
- iv) What helps people stay motivated over time?
 - A. Only external rewards
 - B. A mix of intrinsic and extrinsic motivation
 - C. Doing tasks without any reward
 - D. Avoiding challenges
- v) What is key to success in education and the workplace?
 - A. Focus on personal goals only
 - B. Providing only external rewards
 - C. Creating a motivating environment with both intrinsic and extrinsic factors
 - D. Ignoring people's psychological needs

2. a) Choose ONE WORD AND/OR A NUMBER from the passage for each answer 5×2=
- i) _____ motivation comes from within an individual and is driven by personal satisfaction or curiosity. 10
 - ii) Extrinsic motivation is often influenced by external factors such as rewards or _____.
 - iii) Self-determination theory highlights the importance of three psychological needs: autonomy, competence, and _____.
 - iv) A student who studies to earn high grades is motivated by _____ motivation.
 - v) Successful individuals often find purpose in the process of striving towards their _____.
- b) Write down the summary of the passage. 05

OR

- 2.a) Fill in the blanks with appropriate verbs: 10×1
- i) If I had a lot of money, I (help) ---- the poor who are suffering in the streets every day. = 10
 - ii) I ___ (read) this book for two hours, but I haven't finished it yet because the chapters are quite long.
 - iii) You are used to (work) --- ten hours a day as part of your regular routine.
 - iv) She ___ (not go) to college since Monday because she has been feeling unwell.
 - v) By the time we reached the station, the train ___ (leave) and we had to wait for the next one.
 - vi) I wish I ___ (know) the answer so I could help you solve the problem.
 - vii) While (take) ---- dinner, he received the phone call that changed his mood completely.
 - viii) They ___ (live) here for ten years and they have become familiar with everyone in the neighborhood.
 - ix) The letter ___ (write) yesterday but it has not been sent yet.
 - x) No sooner had I reached the station than the train ___ (arrive) and people rushed to get on board.
- b) Change the sentences as directed 5×1=
- i) Lila fans herself. (Passive) 5
 - ii) The parcel contains important materials. (Passive)
 - iii) Do away with it. (Passive)
 - iv) He shut the door and went out. (Simple)
 - v) v) The weather being cold, we cannot go out. (Compound)

Part B

3. Write an application to the HR Manager of a software company applying for the position of Junior Software Developer along with your recent CV. 15
- 4.a) Discuss Anita Desai's treatment of child psychology in her short story "Games at Twilight" 10
- b) Why Della is a glorious character in the story "The Gift of the Magi"? 05

OR

4. Some people argue that universities should prioritize practical skills and job readiness rather than academic theory or research. To what extent do you agree or disagree? Write at least 250 words. 15

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science and Engineering

Final Examination-2024
Course No: SS 0311 1205
Time: 02 (Two) hours

1st Year 2nd Semester
Course Title: Managerial Economics
Full Marks: 60

N.B. : (i) Use separate answer scripts for each PART
 (iii) Special Instruction (if any)-----N/A-----

(ii) Marks allotted are indicated in the margin

Part A

1. a) Explain the concept of **managerial economics** and discuss how it helps in answering the basic economic questions of **what, how, and for whom to produce**. Give a real-world example of how a corporation solve those three central economics problems. 05
- b) Define supply with its law and name some determinants of supply. Graphically show the intersection of demand and supply that brings the equilibrium and disequilibrium. 04
- c) Define price elasticity with its formula. Identify the responses to a change in price on different types of price elasticity with its numerical measure. 06
2. a) Define supply and critically evaluate the assumption that producers always increase supply when market price rises. To what extent do real-world constraints—such as production capacity, availability of inputs, technology, and market uncertainty—challenge the traditional upward-sloping supply curve? 06
- b) Using the law of diminishing marginal returns, analyze why marginal product rises initially and then eventually declines as more units of a variable input are employed. 04
- c) Analyze the key differences between perfect competition and monopoly in terms of pricing, power, demand curve, profit levels, and market efficiency. Give a short summary of how do these differences influence firm behavior in each market structure? 05

OR

- 2.a) Analyze how a decrease in household consumption spending affects the circular flow of income in both the product market and factor market. What feedback effects might this create for businesses and government? 05
- b) When does the **Marginal Cost** curve intersect the **Average Variable Cost** and **Average Total Cost** curves? 05
- c) Using real-world examples, apply your understanding of the characteristics of four market types to assess the degree of competition in each market." 05

Part B

- 3.a) Define macroeconomics and identify and show the macroeconomic indicators in a diagram. Using the information from the table below, calculate the GDP per capita for the countries to nearest dollar bracket. 04

	Nepal	Sri Lanka	Bangladesh
GDP (PPP \$ bn)	69.9	2518.1	16980.2
Population (Millions)	4.9	64.7	321.8

- b) Analyze how expansionary and contractionary monetary and fiscal policies can be used to control inflation and stimulate economic growth. Provide examples of instruments used in each case and discuss their effectiveness. 05
- c) “Central bank is the bank of bankers” explain. Briefly describe the functions of central bank in controlling the inflation of an economy. 06

- 4.a) Analyze the differences between Gross Domestic Product (GDP) and Gross National Product (GNP). How does net income from abroad affect GNP, and why might GNP be a better measure of national welfare in some cases?" 05
- b) Evaluate the primary, secondary, and contingent functions of money in an economy. How do commercial banks and the central bank complement each other in maintaining monetary stability?" 05
- c) Define unemployment with its types. Differentiate between the ILO Labour Force Survey & the Claimant Count in determining the unemployment in a country. 05

OR

- 4.a) Examine how expansionary and contractionary monetary and fiscal policies can be used to control inflation and stimulate economic growth. Provide examples of instruments used in each case and discuss their effectiveness. 05
- b) Interpret the structure of a government budget. What are the economic implications of a balanced, surplus, or deficit budget? 04
- c) Examine how integrating Sustainable Development Goals into business decisions-making can influence a firm's cost structure, long-term profitability, and competitive advantage. Use examples to support your analysis. 06

Sylhet Engineering College, Sylhet
(Shahjalal University of Science & Technology)
Department of Computer Science and Engineering

Final Examination-2024

Course No: CSE 0613 1237

Time: 03 (Three) hours

1st Year 2nd Semester

Course Title: Data Structures

Full Marks: 60

N.B. : (i) Use separate answer scripts for each PART

(ii) Marks allotted are indicated in the margin

(iii) Special Instruction (if any)-----N/A-----

Part A

1. a) Define Data structure. Explain the types of data structure with example. 02
- b) Evaluate the statement “sparse matrix method can compress a bigger matrix”. 03
- c) What is the sparse matrix of the given matrix 05

0	0	0	0	5	0	0	0
0	0	3	0	0	0	0	0
0	7	0	0	0	0	0	0
0	0	0	0	0	0	9	0
0	0	0	0	0	4	0	0
0	0	0	6	0	6	0	0
0	1	0	0	0	0	0	0
0	0	0	0	0	0	8	0

2. a) What is a saddle point in a matrix? Give example. Find the saddle point of the following matrix: 03

15	7	20	10
21	11	30	34
42	8	25	65

- b) Explain the operations of a queue. 03
- c) Convert the following **infix expression** into its equivalent **postfix notation** using stack. 04

$$X + Y * (Z * W - U) / (V + T)$$
3. a) Write the Ackermann algorithm. 02
- b) Analyze the Tower of Hanoi’s time complexity. 04
- c) Evaluate with example which searching algorithm is the best linear search or binary search. 04

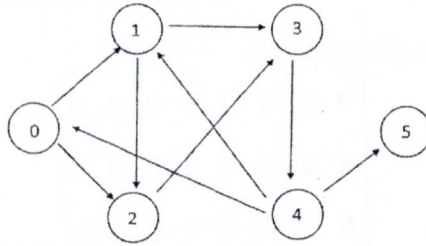
Or

3. a) Which strategy does the Merge sort actually follow? 02
- b) Given Pre-order and In-order traversal of a binary tree. Draw the tree. 04
Pre-order: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, **In-order:** 3, 2, 5, 4, 1, 7, 6, 9, 10, 8, 11
- c) Sort the given array using Merge sort algorithm. Show every step. 04
 [30, 11, 48, 8, 51, 20, 70, 4]

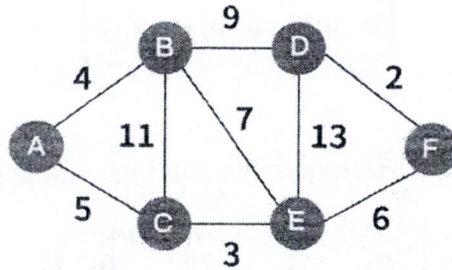
Part B

4. a) What is the main difference between selection and insertion sort? 02
 b) What are level and depth of a tree? 02
 c) Evaluate the bucket sort algorithm using the given array – 06
 [300, 11, 408, 87, 501, 50, 70, 4]

5. a) Define the Depth-First Search (DFS) algorithm and briefly explain its working principle. 04
 b) Analyze DFS travel for the given graph – 06



6. a) Define Max Heap and Mean Heap. 01
 b) Apply Set operation using bitmasks. 02
 c) Use Dijkstra algorithm to find the shortest path from the following graph. 07



Or

6. a) What is minimum cost spanning tree? Give an example of sub-Graph. 02
 b) Explain any pattern matching algorithm. 03
 c) Use Huffman algorithm to construct the binary Huffman tree and determine the corresponding Huffman codes for each node. 05

Node	A	B	C	D	E	F	G	H
Weight	22	5	1	19	2	11	25	5