

University of Dhaka
 Department of Computer Science and Engineering
 2nd Year 2nd Semester Final Examination, 2022
 CSE-2202: Design and Analysis of Algorithms-I

Total Marks: 70

Credit: 3 Credits

Time: 3 Hours

Answer any 5 (five) of the following questions

1. a) "Substitution method can be an effective strategy to find the computational cost of a recurrence relation. This is particularly true when the assumption is appropriate." – Using the substitution method determine whether the following assumption of $T(n) = O(n^3)$ is correct or incorrect for the recurrence relation: $T(n) = 7T(n - 2) + n^2$. Finally, relate your findings to the above double-quoted statement. [6]

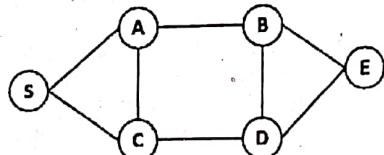
- b) "The Master Theorem offers a cookbook approach for solving all recurrences." – Using the generic mathematical formulation used by the Master Theorem, discuss your thoughts on this statement. In any case, use the master method to give tight asymptotic bounds for the following recurrences: [8]

$$\text{I. } T(n) = 2T\left(\frac{n}{2}\right) + n \lg(n)$$

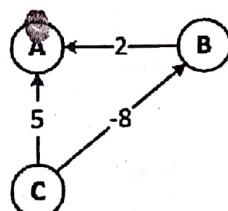
$$\text{II. } T(n) = 5T\left(\frac{n}{2}\right) + \sqrt{n}$$

2. a) Given that topological sorting is a method used to linearly order the vertices of a directed acyclic graph (DAG), how can this technique be effectively utilized to detect the presence of a cycle in a directed graph? Explain the underlying principle of this method, including its limitations, and describe the steps involved in using topological sorting for cycle detection. Additionally, discuss whether this technique can be used to detect the cycle in undirected graphs. [8]

- b) Explain how the function *low()*'s relation with discovery time facilitates the determination of a graph's articulation points. Show all the steps of an algorithm (no pseudo code is required) capable of finding the articulation point in the given undirected graph $G = (V, E)$ having complexity $O(V+E)$. Note that, you must start traversing with the following sequence S, A, B, E, and so on. [6]

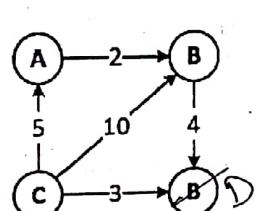


3. a) "Given a weighted graph in which the weights of all edges are distinct (no two edges have identical weights), there is always a unique shortest path from source to destination." – Is this assertion accurate in context of the Dijkstra algorithm? Use a small graph with three nodes and three edges to demonstrate the relevance of your claim. [7]



Apply the Bellman-Ford algorithm to the given graph. In this context, discuss how the Bellman-Ford algorithm enhances the applicability of the single-source shortest path algorithm when compared to Dijkstra's algorithm.

- b) What does "transitive closure" of a graph imply? Tailor the Floyd-Warshall Algorithm using Boolean operators to compute the all-pairs transitive closure of the given graph. Provide the updated recurrence relation and show each step of the algorithm's application on the above Graph. [7]



Can the Floyd-Warshall Algorithm be applied to an undirected graph containing positive cycles? In which situations do we prefer using Johnson's algorithm over Floyd-Warshall for finding all-pair shortest paths, and what is the role of the Fibonacci heap in this context?

4. a) Consider a variant of the matrix-chain multiplication problem in which the goal is to parenthesize the sequence of matrices so as to maximize, rather than minimize, the number of scalar multiplications. Does this problem exhibit optimal substructure? [10]

10 A 15 B 5 C 6 D 8

Now, write down the recurrence relation, and for the chain made up of the four matrices A, B, C and D, find the largest number of scalar multiplications necessary to parenthesize them by using the tailored matrix chain multiplication algorithm. The given figure can help you get a sense of their dimensions. You need to show all the steps (two tables, traceback, etc.)

- b) In the context of algorithm design, the greedy approach is often recommended for its efficiency and simplicity. However, it is not universally applicable. Describe two algorithmic conditions or scenarios where greedy algorithms might not be the most suitable or might fail to deliver an optimal solution. Each of the two points should include suitable real-world applications. [4]

5. a) Consider the principles of algorithm design and optimization, explain how dynamic programming represents a trade-off between computation time and memory usage? Additionally, discuss under what conditions a solution that typically requires exponential time to solve can be transformed into a polynomial-time solution using dynamic programming. [4]

- b) I. Consider the given table, in which each cell value corresponds to a risk factor. An agent is currently at the bottom and aims to reach the peak. However, in each step, it can move to exactly three handholds: one directly above, one above and to the right, and another above and to the left. Now, design a recurrence relation and illustrate all the steps. Then, relate the entire operation to each of the four major Dynamic Programming properties and mention the necessity of a trace-back function within the context of this solution. [10]
 II. Finally write the traceback function (i.e., formal pseudo code) for the solution you have proposed.

8	3	9	7	2	1
8	4	5	4	1	8
4	7	9	2	3	3
2	5	6	3	7	6

6. a) Imagine a small company with three employees: Alice (A), Bob (B), and Charlie (C). The company has three tasks that need to be done: Task 1 (T1), Task 2 (T2), and Task 3 (T3). Note that T2 needs to be done twice, and only Charlie is capable of multitasking with a maximum of 2 tasks at a time. Each employee has different skills, and not everyone is suited to every task. [9]

- Alice can do Task 1 and Task 3.
- Bob can do Task 2 and Task 3.
- Charlie can do Task 1 and Task 2.

- I. Design a flow diagram considering the above scenario. Can we consider the flow diagram as an extended bipartite matching problem? *description?*
 II. Use the Edmonds-Karp algorithm, an extension of the Ford-Fulkerson method, to optimize task distribution among the employees. Ensure that none of the restrictions outlined in the aforementioned scenario are compromised. You must show all the steps of the algorithm, along with the residual networks for each step.

- b) I. Analyze the impact of the choice of augmenting paths in the Ford-Fulkerson method on the computational complexity, and how the Edmonds-Karp algorithm mitigates this issue. Your response should include a clear theoretical explanation of the underlying principles that govern the computational complexities of both algorithms. [5]
 II. In the construction of the residual network for the Ford-Fulkerson method, an additional backward edge is introduced. What role does this backward edge play in the remainder of the method?

7. a) Consider the following array of integers. Find the counting inverse of the array using divide and conquer technique. [7]

17	23	11	8	54	45	48	12	3	1
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- b) You must know about the famous country where everyone is greedy enough to steal every possible thing. Two of the reputed persons of the country are assigned for some resource management task. But alas! They started stealing from these resources too. In the work, they are given N food items, each described by volume (v) and cost (c). One of the assigned people gets a chance to take anything within a total volume limit of V and keep the rest of the items for the other person.
 Design an algorithm to find the maximum cost difference between them after consuming all the items. Note that the chance to take an item comes alternatively. Analyze the time and memory complexity of your algorithm. [7]

University of Dhaka

Department of Computer Science and Engineering

2nd Year 2nd Semester Final Examination, 2022

CSE-2203: Data and Telecommunications

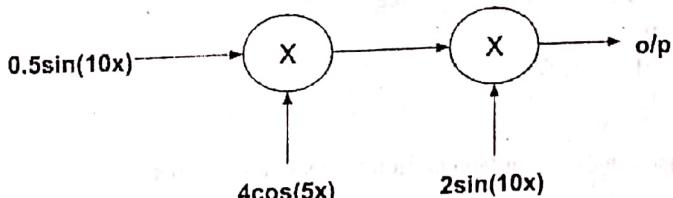
Total Marks: 70

Credit: 3 Credits

Time: 3 Hours

Answer any 5 (five) of the following questions

1. a) What is the purpose of *line encoding*? [2]
 - b) What is *baseband* and *broadband* transmission? We send a voice signal from a microphone to a recorder. Is this baseband or broadband transmission? [3]
 - c) Differentiate between the operations of physical layer and data link layer in the context of OSI model. [3]
 - d) A broadcast network is one in which a transmission from one attached station is received by all other attached stations over a shared medium. Examples are a bus-topology local area network, and a wireless radio network. Discuss the need or lack of need for a network layer (OSI layer 3) in a broadcast network. [3]
 - e) Distinguish between *distortion* and *noise*. [3]
2. a) Consider an audio signal with spectral components in the range of 300 to 3KHz. Assume that a sampling range of 8000 samples per second will be used to generate a PCM signal.
 - I. For SNR = 30dB, what is the number of uniform-quantization levels needed?
 - II. What data rate is required?
 - b) A PCM encoder accepts a signal with a full-scale voltage of 10V and generates 8-bit codes using uniform quantization. The maximum normalized quantized voltage is $1 - 2^{-8}$. Determine (a) normalized step size, (b) actual step size in volts, (c) actual maximum quantized level in volts, (d) normalized resolution, (e) actual resolution. [5]
 - c) Recall the simple amplitude modulator circuit (with all passive components) that you built in your lab. Explain the operation of the LC filter in that circuit? [3]
 - d) What is the significance of multiplying two signals in frequency modulation technique? [2]
3. a) With the help of a constellation diagram, explain the operation of a 16-QAM. [4]
 - b) Let $m_1(t)$ and $m_2(t)$ be message signals and let $s_1(t)$ and $s_2(t)$ be the corresponding modulated signals using a carrier frequency of f_c . Show that if simple AM modulation is used, then $m_1(t) + m_2(t)$ produces a modulated signal that is a linear combination of $s_1(t)$ and $s_2(t)$. [3]
 - c) Consider two periodic functions $f_1(t)$ and $f_2(t)$. Is it always the fact that $f(t) = f_1(t) + f_2(t)$ be periodic all the time? If so, demonstrate this fact. If not, under what conditions $f(t)$ will be periodic? [3]
 - d) Decompose the output signal (see the given diagram) into a linear combination of sinusoidal functions, and find the frequency and the phase of each component and represent it in the frequency domain. [4]
4. a) A TV channel has a bandwidth of 6 MHz. If we send a digital signal using one channel, what are the data rates if we use one harmonic, three harmonics, and five harmonics? [3]
- b) A nonperiodic composite signal contains frequencies from 10 to 30 KHz. The peak amplitude is 10 V for the lowest and the highest signals and is 30 V for the 20-KHz signal. Assuming that the amplitudes change gradually from the minimum to the maximum, draw the frequency spectrum. [2]



✓ Study the works of Shannon and Nyquist on channel capacity. Each places an upper limit on the bit rate of a channel, based on two different approaches. How are the two related? [2]

✓ A periodic band-limited signal has only three frequency components: dc, 100 Hz, and 200 Hz. In sine-cosine form:

$$x(t) = 12 + 15 \cos 200\pi t + 20 \sin 200\pi t - 5 \cos 400\pi t - 12 \sin 400\pi t.$$

Express the signal in amplitude/phase form.

✓ e) Given a channel with an intended capacity of 20 Mbps. The bandwidth of the channel is 3 MHz. What signal-to-noise ratio is required to achieve this capacity? [3]

5. a) Can an FHSS and DSSS co-exist? Justify your answer. [2]

b) The chip sequences of four CDMA transmitters are: [5]

$$A = (-1 -1 -1 +1 +1 -1 +1 +1 -1 +1)$$

$$B = (-1 -1 +1 -1 +1 +1 +1 -1 +1 -1)$$

$$C = (-1 +1 -1 +1 +1 +1 -1 -1 +1 -1)$$

$$D = (-1 +1 -1 -1 -1 +1 -1 +1 -1 +1)$$

Assume the CDMA receiver gets the following chips: $(-1 +1 -3 +1 -1 -3 +1 +1 -2 +1 -1 +1)$. Find out which stations transmitted, and which bits did each one send.

c) Calculate the hamming pairwise distances along the following codewords {000100, 010101, 101010, 110110} [5]

d) An FHSS system employs a total bandwidth of $W_s = 400$ MHz and an individual channel bandwidth of 100 Hz. What is the minimum number of PN bits required for each frequency hop? [2]

6. a) For $g(x) = 110101$ and $d(x) = 1110010011$, find the CRC using long division. [4]

b) Can the value of a traditional checksum be all zeros? Defend your answer. [2]

c) The polynomial of a CRC generator code is: $x^{19} + x^{16} + x^{15} + x^4 + 1$. Does it detect a burst error of size 19 bits? Does it detect any odd number of error bits? Defend your answer. Also find the probability of failing to detect a burst error of length 20? Is it a good CRC code? [6]

✓ Explain why a generator polynomial in CRC always contains the x^0 term. [2]

7. a) Calculate the baud rate for the given bit rate and type of modulation. [4]

- i) 2000 bps, FSK
- ii) 4000 bps, ASK
- iii) 6000 bps, QPSK
- iv) 36,000 bps, 64-QAM

b) The telephone line has 4 KHz bandwidth. What is the maximum number of bits we can send using each of the following techniques? Let $d = 0$. [3]

- i) ASK
- ii) QPSK
- iii) 16-QAM

✓ Describe QPSK implementation with suitable figures. [7]

University of Dhaka
Department of Computer Science and Engineering
2nd Year 2nd Semester Final Examination, 2022
Computer Architecture and Organization (CSE - 2204)
Total Marks: 70 Credit: 3 Credits Time: 3 Hours

Answer any 5 (five) of the following questions

1. a) What are the advantages of using a carry save adder? Discuss the concept of carry save addition using $W = 10011110$, $X = 10011011$ and $Y = 11101101$. Compare it with the traditional addition using the same example. 2+3 = 5
- b) Discuss the advantage of Booth's multiplication over the sequential multiplication. Multiply 4×7 using Booth's multiplication algorithm with a detailed explanation of each step. 2+5=7
- c) Discuss the advantages of a non-restoring division algorithm. 2
2. a) Add 0.5 and -0.4375 using floating point addition. Represent the outcome of the addition using IEEE-754 32-bit format. You must show and explain each step of the addition operation. 4+2=6
- b) Compare the mechanism of spatial and temporal expansion of ALU. 4
- c) Draw a 1-bit ALU that can perform AND, NOR, NAND and Addition operations. You must explicitly mention the control signals and explain how this ALU can perform the above-mentioned operations. 4
3. a) Show the MIPS instruction format for each of the following instruction and then derive the decimal representation: 4+3=7
- | | |
|--------------------------|-----------------------------|
| (1) sub \$t1, \$s3, \$s5 | [opcode = 0 and funct = 34] |
| (2) lw \$t1, 150(\$t0) | [opcode = 35] |
| (3) beq \$s3, \$s4, 200 | [opcode = 4] |
- For (2) and (3), mention the addressing mode and describe how memory address is calculated.
- b) Draw the necessary circuit of a single cycle processor to execute the lw and beq/bne instructions. You need to discuss the steps needed to execute the above-mentioned instructions using the single cycle processor. You do not need to consider the control signals to answer this question. 3+4=7
4. a) Write the corresponding ARM code, where the variables a and b are assigned to registers r1 and r2, respectively. 5
- ```

while (a != b) {
 if (a > b)
 a = a - b;
 else
 b = a + b;
}

```
- b) Write down the differences between RISC and CISC processors. 5
- c) Describe the working principle of a carry look-ahead adder. What are the disadvantages of a carry look-ahead adder? 5
5. a) What is delayed branching? Discuss the strategies of implementing a delayed branching. 2+3=5
- b) Suppose  $X = x_3x_2x_1x_0$  and  $Y = y_3y_2y_1y_0$ . Discuss the combinational array multiplier to implement  $X \times Y$  using necessary circuit representations. 5
- c) Discuss the pros and cons of different types of write operations performed by a cache memory. 4

6. a) What is the equivalent one-address machine code of  $(A \cdot B + C) / (A - B \cdot C)$ ? 4
- b) Draw the block diagram of a single cycle processor datapath with necessary control signals. Highlight the datapath in the figure involved in the operation for a STORE instruction. 5
- c) Write down the fast code for executing the following instructions to avoid Load hazards 5  
 $a = b - c;$   
 $d = e - f;$   
assuming a, b, c, d, e, and f are in memory.
7. a) Compare programmed I/O with interrupt driven I/O. 5
- b) Discuss both models of Multiple Input, Multiple Data Stream (MIMD) architecture with appropriate block diagrams. 3
- c) What is direct memory access? Discuss how a DMA controller works with a processor, memory device and I/O devices with a block diagram. 2+4=6

University of Dhaka  
Department of Computer Science and Engineering  
2<sup>nd</sup> Year 2<sup>nd</sup> Semester Final Examination, 2022  
CSE-2201 Title- Database Management Systems-I

Total Marks: 70

Credit: 3 Credits

Time: 3 Hours

Answer any 5 (five) of the following questions

1. Suppose you have joined a new mobile phone operator namely "বাচাল" as a database designer. বাচাল offers voice calls (metered by 30 seconds), short messaging service (SMS) (metered by each 160 or less character blocks), and Internet (metered by jointly GB and bits-per-seconds). Each of the services has different rates for different types of offering packages. For example, a package "কবেকাক" (কথা বেশি কাজ কর) has package rates 0.50 per 30s, 3.0 per block, 1.0 per mb; whereas "ফেটাল / মেটাল" (ফেসবুক / মেজিয় টাল) package has package rates 1.0 per 30s, 3.0 per block and 0.25 per mb, (for the voice, sms and Internet services, respectively). There is a prepaid deposit per subscriber and s/he can use the services until his/her usage does not exceed the deposit. A customer can add money (increase the deposit) anytime.

The mobile subscribers purchase a connection from the বাচাল operator and choose one of the offered packages as per his/her requirements. The database should keep a record of service usage by a subscriber and prepare a monthly bill for each subscriber.

The company expects that the database will be capable of serving the following queries:

- i. Finding the customer that used a service (voice/SMS/Internet) the most under a package.
- ii. Finding the most paid customers per package in the last n months.
- iii. Finding the least usage customers per package in the last n months.
- iv. Finding the hourly service usage in minutes per service of a customer in a day.

Based on the scenario above, answer the following:

- a) Draw an E-R diagram for the database. 8
- b) Find the tables and columns that should be indexed and write down the SQL statements to implement the indices. 6

2. Suppose a designer designed the following tables for University Grants Commission (UGC):

*Universities = (univ\_id, univ\_name, country)  
Subjects = (sub\_id, sub\_title)  
Programs = (prg\_id, prg\_title, univ\_id, sub\_id, capacity, mincredit)  
Enrollments = (sutd\_id, prg\_id, session, expire, state)*

where *capacity* is the number of seats in the program, *mincredit* is the minimum credit to obtain the program degree, a *session* is the academic session (eg. 2023), *expire* is the expire date of the session enrolment and *state* is the current state of the student in the session. The state can be one of the following: (a) ENROLLED, (b) COMPLETED, (c) DROPPED and (d) EXPIRED.

- a) Discover the required constraints for the relations with their types. 5
- b) Write the SQL statements to create the relations with the required constraints. 6
- c) Write SQL statements to modify the tables mentioned in question 2.  
i. Remove the *mincredit* column from the programs table.  
ii. Add two new columns *creditstaken*, and *GPA*, in the *enrollments* table. 3

3. Answer the following questions considering the relations in question 2.

- a) Write relational algebra expressions for the following:  
i. Find the students with 'ENROLLED' state of the 'DHAKA UNIVERSITY' studying 'CSE'. 1  
ii. Find all universities that run a program for the subject 'Sociology'. 2  
iii. Find the number of students for each university. 2
- b) Write SQL statements for the queries mentioned in question 3.a). 5

- c) What are the benefits of assigning a name for each constraint? Explain with an example. 4
4. a) Define trivial functional dependency. List all nontrivial functional dependencies (with no common attributes) satisfied by the following relation: 5
- | A  | B  | C  |
|----|----|----|
| a1 | b1 | c1 |
| a1 | b1 | c2 |
| a2 | b1 | c1 |
| a2 | b1 | c3 |
- b) What is 'closure of set of attributes',  $\alpha^+$ ? What is the usage of  $\alpha^+$ ? 1+3
- c) Consider a relation schema  $R = (A, B, C, D)$  with  $F = \{A \rightarrow BC, B \rightarrow D, D \rightarrow B\}$ . Is it possible to meet all the design goals by a smart decomposition of  $R$  into  $R_1$  and  $R_2$ ? Explain why or why not. 5
5. a) In the BCNF decomposition algorithm, suppose you use a functional dependency  $\alpha \rightarrow \beta$  to decompose a relation schema  $P(\alpha, \beta, \gamma)$  into  $Q(\alpha, \beta)$  and  $R(\alpha, \gamma)$ .  
 i. What primary and foreign-key constraint do you expect to hold on the decomposed relations?  
 Justify.  
 ii. Give an example of an inconsistency that can arise due to an erroneous update if the foreign key constraint were not enforced on the decomposed relations above. 4+2
- b) Can there be different canonical covers for a given set of dependencies? Justify your answer for the following set of functional dependencies: 4
- (i)  $\alpha \rightarrow \beta\gamma$ , (ii)  $\beta \rightarrow \alpha\gamma$ , and (iii)  $\gamma \rightarrow \alpha\beta$
- c) Write and explain the extraneous attribute removal algorithm. 4
6. a) Explain how the primary and candidate keys are related to the set of functional dependencies. 4
- b) Consider the set  $F$  of functional dependencies for relation schema  $R = (A, B, C, D, E, F, G)$ .  
 $A \rightarrow BC$   
 $CD \rightarrow EF$   
 $B \rightarrow DG$   
 $E \rightarrow A$  6
- Find the closure of attribute A (i.e.,  $A^+$ ) for the schema and set of functional dependencies. 4
- c) "Every 3NF schema is in 2NF." - Justify the statement. 4
7. a) List some major steps that you would take in setting up a database for a particular enterprise. 3
- b) Explain the difference between two-tier and three-tier application architectures. Which is better suited for web applications? Why? 4
- c) Graphically show the steps for query processing. 2
- d) Who is a DBA? Mention the tasks of a DBA. 1+4

University of Dhaka

Department of Computer Science and Engineering

2<sup>nd</sup> Year 2<sup>nd</sup> Semester Final Examination, 2022

CSE-2205: Introduction to Mechatronics

Total Marks: 70

Credit: 2 Credits

Time: 3 Hours

Answer any 5 (five) of the following questions

1. a) What do you mean by Mechanics, Kinematics and Kinetics? Explain it with a suitable diagram. [2]

- b) Determine the magnitude and direction of force  $F_1$  shown in the given figure Fig. 1. [4]

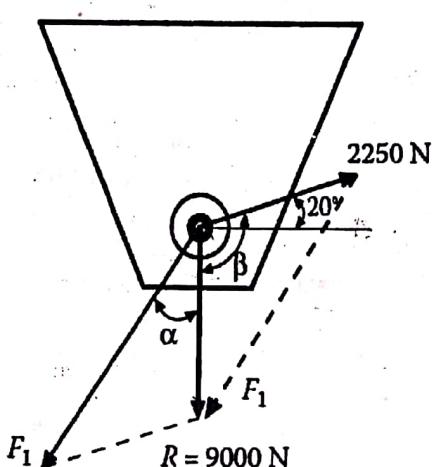


Fig. 1

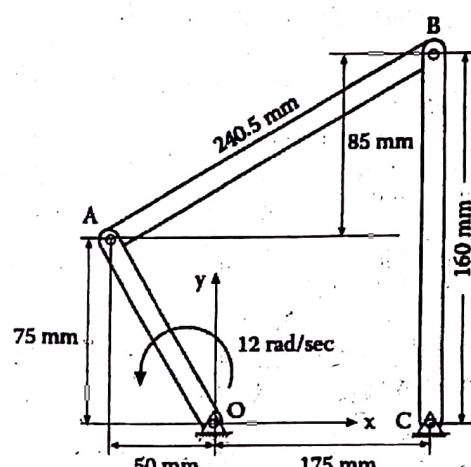


Fig. 2

- c) The three-bar link OA shown in figure Fig. 2 has a counterclockwise angular velocity of 12 rad/s during a short interval of motion. When link CB is vertical, point A has coordinates (-50 mm, 75 mm). Determine the angular velocity of links AB and BC. [8]
2. a) Define gear and gear ratio. If the gear ratio is 2.5:1, compute the number of teeth of the driver and the driven gear. [4]
- b) Define viscosity of a liquid. Mention the viscosity of an ideal fluid. [2]
- c) Describe the working principle of a DC motor. [6]
- d) Consider an electric motor working with input voltage 200 volt and input current 50 amperes. Its output is 30 kilo watt. Calculate the efficiency of this electric motor. [2]

3. a) Describe two types of remote sensing sensors. [3]
- b) What is the main difference between mechanical and electrical transducers? [2]
- c) Describe the types of sensors which are used in robotics. [4.5]
- d) Define the moment of inertia of a rotating body. Consider two steel balls (mass 500 gm and 1 kg) that are welded in the two terminals of a rod (length 2 meters) that is attached to a bar at its mid-point. Compute the moment of inertia of this system. Mention the assumptions we have to make to solve this problem. [4.5]

4. a) Define thermal capacitance and specific heat of a matter. What is the relation between these two parameters? [3.5]
- b) One end of a 0.25 m long metal bar is in steam and the other in contact with ice. Amount of heat conducted per minute is 1200 cal. Calculate the thermal conductivity of the metal? Given cross section of the bar is  $7 \times 10^{-4} \text{ m}^2$ . [2.5]
- c) Define control system. Distinguish between linear and non-linear control systems. [5]
- d) What is meant by the stability and the robustness of a control system? [3]
5. a) Enlist three variables that are needed for a control system and show the components of a sensor by which any one variable could be measured. [4]
- b) Explain how a calibration process contributes to sensor accuracy. [4]
- c) Consider a tachometer with a gain of  $2V/1000 \text{ rpm} = 2V/\text{krpm}$ . It is interfaced to a data acquisition system through an analog to digital converter (ADC) which has 12-bit resolution and  $\pm 10V$  input range. The sensor specifications state that the ripple voltage due to commutators on the tachometer is 0.25% of the maximum voltage output.
- I. Determine the maximum speed that the sensor and data acquisition system can measure.
  - II. What are the measurement errors due to the ripple voltage and due to ADC resolution?
  - III. If the ADC was 8-bit, which one of the error sources is more significant: ripple voltage or ADC resolution?
6. a) Describe the basic steps in the operation of PLC. Show its working block diagram. [6]
- b) Consider the design of a Burglar Alarm for a house. This alarm will be activated if an unauthorized person is detected by a window sensor (current is always passing until there is a breakage in glass) or a motion detector. Implement this alarm system in PLC using Ladder Diagram and FBD programming language. [6]
- c) What is a relay? Show the diagram of a relay. [2]
7. a) Enlist three factors which are needed to design a flexible manipulator efficiently. [5]
- b) How does the safety factor contribute to a manipulator design? [5]
- c) Motor inertia,  $J_m$ , for a typical 27 W motor is given as  $J_m = 20 \times 10^{-7} \text{ kg m}^2$ . If the gear ratio is 10, then the reflected motor inertia on the load side  $J_{me}$  is  $0.0002 \text{ kg m}^2$ . If someone is driving a load of 2 kg on wheels of 0.03 m radius mounted on an axis to which the output side of the gear system is attached, compute the moment of inertia of the load at the drive wheel. [4]