

Mawlana Bhashani Science and Technology University
Department of Information and Communication Technology
3rd Year 1st Semester B.Sc. (Engg.) Final Examination 2023

Course Title: Operating System
 Course Code: ICT 3109

Time: 3 hours
 Marks: 70

Answer any 05 (FIVE) questions

1. a) Define the operating system. List a few different operating systems. Explain the main purpose of an operating system. 5
- b) What are the benefits of a multiprocessor system? 2
- c) What is the Batch Operating System? What are the benefits and disadvantages of a Batch Operating System? 4
- d) What is spooling in OS? What is the difference between Kernel and OS? 3

2. a) Define process. Describe process state with appropriate figure. 5
- b) "Kernel mode is called privilege mode" – explain this fallacy. 4
- c) Explain process control block (PCB) with diagram. 5

3. a) Differentiate preemptive and non-preemptive scheduling. In which CPU scheduling algorithm convey effect occurs. By which algorithm we can solve it. 4
- b) Consider the following table for a uniprocessor system: 10

Process ID	Arrival Time (μs)	CPU Time (μs)	Priority
P1	4	5	2
P2	6	6	3
P3	3	4	4
P4	0	3	5
P5	1	3	6
P6	2	4	7

By implementing SRTF/Priority (Preemptive) (In the priority column higher number higher priority is), HRRN, RR (time quantum tq = 1 μs, Here 1 μs = 1×10^{-6} sec)

- (i) Sketch the respective Gantt chart for each above-mentioned algorithm.
- (ii) Determine average waiting time, response time, turnaround time, and throughput.
- (iii) Comments on results.

4. a) What is fork(); ? How many children and parents will be produced for the following segment of C code? Explain briefly.

<p>(i)</p> <pre>#include<stdio.h> #include<unistd.h> int main() { fork(); printf ("ICT\n"); return 0; }</pre>	<p>(ii)</p> <pre>#include<stdio.h> #include<unistd.h> int main() { fork(); fork (); printf ("MBSTU\n"); return 0; }</pre>
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4. b) What is a semaphore? What is the difference between binary semaphores and counting semaphores? 4
- c) Describe critical section problem. Explain the steps of addressing this issue. 6
5. a) Explain the concept of demand paging and its advantages. 4
- b) How many types of fragmentation occur in the Operating System? Explain Internal and External fragmentations. 5
- c) A 512MB block of memory is allocated using the buddy system. Demonstrate the results of the following sequence of requests and releases using figures: Request A: 14MB; Request B: 52MB; Request C: 112MB; Release A; Request D: 63MB; Release C; Release B; Release D. 3
- d) Why Linux is more secure than Windows operating system? 2
6. a) Consider the following system:
- | Process | Allocation | | | | Max | Total Resources |
|---------|------------|---|---|---|-----|-----------------|
| | A | B | C | D | | |
| P1 | 0 | 0 | 1 | 2 | 0 | 1 |
| P2 | 1 | 0 | 0 | 0 | 1 | 5 |
| P3 | 1 | 3 | 5 | 4 | 2 | 2 |
| P4 | 0 | 6 | 3 | 2 | 0 | 6 |
| P5 | 0 | 0 | 1 | 4 | 0 | 6 |
- (i) Find the need matrix. 2
- (ii) Is the system being safe? If safe, then find the safe sequence. 2
- (iii) What will happen if process P1 requests one additional instance of resource type A and two instances of resource type C? 2
- b) What are the four necessary and sufficient conditions behind the deadlock. 3
- c) Consider a system consisting of four resources (R1, R2, R3, and R4) and three processes (P1, P2, and P3). R1 consists of 1 instance, R2 consists of 2 instances, R3 consists of 3 instances, R4 consists of 3 instances. Here, P1 requests for R1, P2 requests for R3, P3 requests for R2, R2 is held by P1, R2 is held by P2, R1 is held by P2, and R3 is held by P3.
- (i) Draw the resource allocation graph for the above system. 3
- (ii) Find out if there is any deadlock in the above system. Justify your answer. 2
7. a) For a system memory partitions and process size are placed in tabular form. Apply the First fit, Best fit, and Worst fit Dynamic algorithm and show how would they be placed in memory portions. 5

Memory partitions (in order) (KB)	Process size (in order) (KB)
75	Process P1 = 212
760	Process P2 = 470
225	Process P3 = 150
350	Process P4 = 115
120	Process P5 = 436
175	
550	

7. b) Considering the segment table.

4

Segment Base	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96
5	456	568

What are the physical addresses for the following logical addresses?

- (i) 0,430
- (ii) 1,10
- (iii) 2,500
- (iv) 3,400
- (v) 4,112
- (vi) f. 5,12

- c) Consider the following sequence of page references:

A B C D E C D A F I H G H I G H I E D E D B

5

- (i) Apply the two-page replacement algorithms (using three frames), such as, Least Recently Used (LRU), and CLOCK to trace the page references.
- (ii) Construct a performance analysis graph and determine which algorithm is the best.

8. a) Suppose that a disk drive has 5,000 cylinders numbered 0 to 4999. The drive is currently serving a request at cylinder 2150, and the previous request was at cylinder 1805. The queue of pending requests, in FIFO order, is:

2069, 1212, 2296, 2800, 54, 1618, 356, 1523, 4965, 3681

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms?

6

- (i) SSTF
- (ii) LOOK
- (iii) C-SCAN

- b) Consider a typical disk that rotates at 30000 RPM and has a transfer rate of 25×10^6 bytes/sec. If the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time,

8

- (i) Calculate the average seek time.
- (ii) Calculate the average rotational delay.
- (iii) What is the average time (in milliseconds) to read or write a 256-byte sector of the disk?
- (iv) Calculate the controller's transfer time.

Class test - I

Course Title: Microprocessor and Assembly Language
Course Code: ICT-3105

Time: 35 minutes

Full Marks: 20

- 1 Define *Microprocessor*. Briefly describe the technique of *Linear Decoding and Full/Partial decoding* in main memory array design. 5
 - 2 Draw the main architecture of 8086 *Microprocessor* and explain it's *Bus Interface Unit(BIU)* 6
 - 3 How 8086 *Microprocessor* switch from minimum mode to maximum mode and Vice-versa? 5
Explain all the minimum mode's activated pins along with their pin number and functionalities
 - 4 Write short notes on Based and Index addressing modes. What do you know about *CMPS, STI* instruction. 4
-

Class test - III

Course Title: Microprocessor and Assembly Language.
Course Code: ICT-3105

Time: 35 minutes

Full Marks: 20

- 1 *Assembly language* is a low-level language- do you agree? Explain your answer. 3
- 2 How does 8086 generate 20-bit physical address using 16-bit logical address? 3
- 3 Write an assembly program to read one of the hex digits A-F, and display it on the next line in decimal. 5

Sample execution: Enter a HEX digit: C

In Decimal it is 12

- 4 Draw the operational flowchart of *FOR* and *REPEAT loop* in aspects of *assembly language*. 4
- 5 Write an *Assembly language* program that takes input in AL. if AL contains 1, 3, 7 then display 'O' for odd value and if AL contains 2, 4, 8 then print 'E' for even. For any other input it gives option to enter again among the defined values. 5

[BEST OF LUCK]



Mawlana Bhashani Science and Technology University
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Course Title: Microprocessor and Assembly Language

Marks: 70

Course Code: ICT 3105

Time: 3 hours.

Answer any 05 (FIVE) questions

1. a) What is a microprocessor? Briefly explain the main components inside the microprocessor. 4
- b) Explain the technique of Full/Partial decoding and Programmable Array Logic (PAL) in main memory array design. 6
- c) Write down the key features of 8086 Microprocessor. 4
2. a) Draw the main architecture of 8086 Microprocessor and explain its Bus Interface Unit (BIU). 6
- b) How does 8086 Microprocessor switch from minimum mode to maximum mode and Vice-versa? 3
- c) What are the addressing modes? Write at least five (5) addressing modes. Identify the addressing modes of the following instructions. 5
- i) MOV AL, 35H
ii) MOV AX, [BX]
iii) ADD AX, [BX+SI]
3. a) Write down the key operations of Accumulator, Counter, and Source index (SI) of 8086 registers. 5
- b) Briefly explain the 80186 microprocessor's programmable interrupt controller and programmable DMA functional unit. 6
- c) List out the ten (10) new additional instructions of 80186 microprocessor beyond 8086 microprocessor. 3
4. a) Draw and discuss the functional block diagram of 80286 microprocessor. 6
- b) Briefly explain the different operational mode of 80286 microprocessor. 3
- c) Describe the 80386 Flag registers with appropriate illustration. 5
5. a) Write down the important features of Intel's Core i5 and i7 microprocessor. 5
- b) What is Turbo Boost Technology for Intel's microprocessor? Explain with proper diagram. 5
- c) Briefly explain the Intel's core i9 microprocessor with its advantage and disadvantage. 4

6. a) What are some advantages and disadvantages of using assembly language compared to higher-level language like C or Python? 4
- b) What are *dup* and *equ* operational codes (opcode) in assembly language? Explain with appropriate example. 4
- c) Write an assembly language program to read one of the hex digits A-F, and display it on the next line in decimal. 6
- Sample execution: Enter a Hex digit: C
In decimal it is: 12
7. a) Draw the operational flowchart of FOR and REPEAT loop in aspects of assembly language. 4
- b) Write an Assembly language program that takes input in AL. If AL contains 1, 3, 7 then display 'O' for odd values and if AL contains 2, 4, 8 then print 'E' for even. For any other input, it gives option to enter again among the defined values. 6
- c) What will happen when a Test instruction is being executed? Suppose DH contains 8Ah and CL contains 2. What are the values of DH and of CF after the instruction SHR DH,CL is executed? 4
8. a) What is Stack? What happens when a Push operation occurs in a Stack? Explain with a neat diagram. 4
- b) Write a program using STACK to display initially a "?" and then read input/s until a carriage return count and finally display them in reverse order. 5
- c) What is a macro? How do you define a macro? 2
- d) Write a macro to move a word into a word. 3

Mawlana Bhashani Science and Technology University
Department of Information and Communication Technology
2nd Year 1st Semester B.Sc. (Engg.) Final Examination 2022

Course Title: Algorithm Design and Analysis
Marks: 70

Course Code: ICT-2107
Time: 3 Hours

Answer any 5 (Five) from the following 8 (Eight) questions

1. For the following code blocks calculate the worst-case time complexity:

- a)

```
int total = 0;
for (int i = 0 ; i < n ; i++) {
    for (int j = 0; j < n; j++) {
        total += j * i;
    }
}
```

 [3]
- b)

```
int val = 0;
for (int i = 0 ; i < n * n * n ; i++) {
    val += i;
}
```

 [3]
- c)

```
for (int i = 0 ; i <= n ; i *= k) {
    // some O(1) expression
}
```

 [3]
- d)

```
int i = 1;
int sum = 0;
while (i < n) {
    sum += i;
    i *= 2;
}
```

 [3]
- e) Write a tabular difference among different complexity notations. [2]

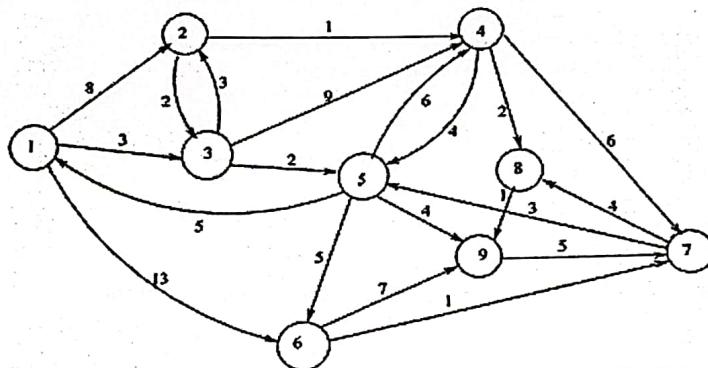
2. a) Define divide and conquer problems. Run Quicksort Algorithm to show all the possible steps for finding pivot 32 in its final place from the following unsorted array:
A = [41, 54, -10, -9, 89, 12, 31, 41, 75, 51, 32] [8]
- b) Both Mergesort and Quicksort algorithms follow the divide and conquer approach and their run time complexity in average case is O(n logn). In terms of space complexity, Quicksort is better than Mergesort. Explain why. [3]
- c) Which sorting algorithm will you use to sort an almost sorted array? Explain the reason for your choice. [3]
3. a) Suppose the following seven numbers are inserted in order into an empty binary search tree (BST): 40, 60, 50, 33, 55, 11, and 35. Answer the following questions regarding BST.
- Build a binary search tree by showing each stage of the drawing.
 - Simulate the BST searching algorithm to find whether 20 is in the BST.
- Simulate the BST insertion algorithm to insert 20 in the BST.
- b) Show the steps in solving the 4-Queens problem using the backtracking method. [3]
- c) Define the Hamilton circuit problem with an example. [3]
4. a) Write down the differences between Max Heap and Min Heap with proper example. [3]
- b) Write down the pseudocode of the Heapify algorithm. [4]
- c) How Insertion and Deletion occurs in heaps? Explain for both max and min heap. [7]
5. a) What are the basic components in Dynamic Programming algorithms? [2]
- b) Consider the following two sequences, Find the length of the longest subsequence present in both of them. Also, find out the longest common subsequence.
- X = BACDB
 - Y = BDDB
- c) Write the Pseudocode of MatrixChainOrder. [4]
- d) Define parenthesization in Matrix Chain Multiplication algorithm. [2]

6. a) Given n groups of people of different sizes G_1, G_2, \dots, G_n and minibuses with capacity c , your task [8] is to design a greedy algorithm to assign each group to a minibus such that the number of total required minibuses is minimized. You can assume that all group sizes are smaller than or equal to the minibus capacity, you also have to assign each group in such a way that all members of the same group stay together.

For example, if there are 6 groups of people, of group sizes 3, 1, 6, 4, 5, and 2 and the capacity of each minibus is 7, you need only 3 minibuses to assign all the groups if assign group of size 6 and 1 in the first minibus, group of size 5 and 2 in the second minibus and group of size 4 and 3 in the third minibus.

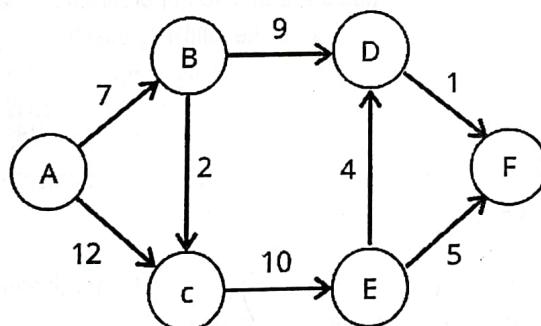
- b) "Greedy approach cannot achieve a global optimum solution in many cases" – Justify the [3] statement with a proper example.
 c) Define Dynamic Programming. How can we calculate $F(20)$ using the concept of dynamic [3] programming in the Fibonacci series?

7. Considering the graph answer the following question precisely:



- a) Write the 2 types of representation of the above graph. [3]
 b) Suppose the nodes denote an individual place. Now traverse the places using BFS and DFS [6] Algorithm.
 c) Calculate the minimum spanning tree for the above graph. Show each necessary steps. [5]

8. Considering the graph answer the following question precisely:



- a) Define the following terms: [3]
 i. BST
 ii. Height of a tree
 iii. Siblings in a tree
 b) Write the Pseudocode of Breadth First algorithm. [5]
 c) Use Dijkstra's algorithm to find the cost of the shortest path between A and F using the above [6] graph.

What is meant by Analog Communication in information communication engineering? Draw a typical block diagram of an analog communication system. Hence define signal, channel, noise, modulation and demodulation.

Course Title: Analog and Digital Communication
Full Marks: 70

Course Code: ICT 3103
Time: 3 hour

Answer any five from the following questions

1. (a) What is communication system? Draw the block diagram of a communication system and explain the function of each block. 6

- (b) Define the bandwidth of a signal. List the bandwidth of few real-world signals. 3

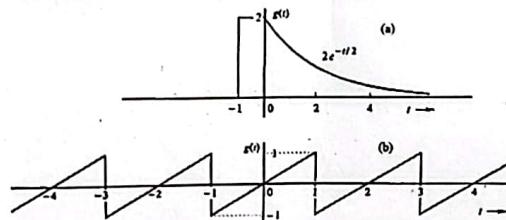
- (c) As an engineer, what are the important characteristics of a channel you should consider. Write the name of three mostly useful channel and which one is advantageous-why? 5

2. (a) What are the limitations of communication systems? 2

- (b) Define modulating signal and carrier signal. Write the necessity of modulation in communication system? 6

- (c) With proper sketch, compare AM, FM, and PM. 6

3. (a) Determine the suitable measures of the signal in the following figure: 5



- (b) What is spectrum? Sketch the line spectrum of the following signal: $g(t) = 3 - 5 \cos(40\pi t - 30^\circ) + 4 \sin(120\pi t)$ 6

- (c) Find the Fourier transform of the everlasting sinusoid $\cos\omega_0 t$ and draw its spectrum. 3

4. (a) With the help of waveforms and spectrum, describe the concept of Amplitude modulation both in time domain and frequency domain. 5

- (b) As related to AM, what is over modulation, under modulation and 100% modulation? What happens for over modulation? 6

- (c) Show that transmission efficiency of AM wave is $\frac{\overline{x^2(t)}}{[A^2 + \overline{x^2(t)}]} \times 100\%$, where each symbols have their meanings. 3

5. (a) What are the basic steps to convert from analog to digital signals? 3

- (b) What is detector? What are the challenges of coherent detector? 3

- (c) Describe a synchronous detection method. 4

- (d) For FM Modulator with frequency deviation of 10 kHz, modulating signal frequency of 10 kHz, Carrier amplitude voltage of 50V and Carrier frequency of 500 kHz, determine Minimum Bandwidth using Carson's rule. 4

6. (a) With necessary circuit diagram and waveforms, explain how DSB-SC wave is generated using: 5

- i. Balance Modulators and
- ii. Ring Modulator

- (b) What are the advantages of SSB over DSB modulation technique? 3

- (c) What is the concept of VSB? Compare among DSB, SSB and VSB. 6

7. (a) Define PAM, PWM, PPM and write their applications. 3

- (b) State and explain sampling theorem 5

- (c) What is aliasing effect. How to avoid it? 3

- (d) Determine the signal to quantization noise ratio of PCM system. 3

8. (a) What is quantization? Show that the SQR for a sinusoidal input signal is $SQR = 1.76 + 6.02n \text{ dB}$. Draw a table to show that how additional code bit improves SQR. 7

- (b) Mention the desirable properties of line coder. 4

- (c) Construct NRZ and RZ format for 011010. 3

Mawlawi Bhashani Science and Technology University

Department of Information and Communication Technology

2nd Year 2nd Semester BSc (Engg.) Final Examination 2022

Course Title: Financial and Managerial Accounting

Marks: 70

Course Code: ICT 2213

Time: 3 hours

Answer any 05 (FIVE). Maintain sequence while answering questions

1. (a) What is accounting? 2
(b) Explain accounting equation. 4
(c) What is 'financial statements'? Explain the interrelationship among the financial statements. 8

2. (a) What is 'Business Entity Concept'? 2
(b) What is 'Accounting Cycle'? Explain each step of 'Accounting Cycle'. 9
(c) Distinguish between 'temporary accounts' and 'permanent accounts.' 3

3. (a) What are the limitations of financial statements? 2
(b) From the following balance sheet, you are required to prepare a common-size balance sheet and interpret the results. 12

Balance Sheet

<u>Liabilities and Capital:</u>	2019 (Tk.)	2020 (Tk.)	<u>Asset:</u>	2019 (Tk.)	2020 (Tk.)
Share Capital	1,40,000	1,50,000	Cash in Hand	2,20,000	2,21,500
Short-term Loans	5,20,000	5,40,000	Cash at Bank	9,000	10,000
Long-term Debt	2,00,000	1,75,000	Accounts Receivable	3,80,000	2,70,000
Bills payable	25,000	2,000	Inventories	1,40,000	1,56,000
Sundry Creditors	20,000	30,000	Bills Receivable	45,000	45,500
Bank Overdraft	89,000	1,23,000	Prepaid Expenses	11,000	21,000
Notes Payable	11,000	20,000	Fixed Assets	2,00,000	3,16,000
	<u>10,05,000</u>	<u>10,40,000</u>		<u>10,05,000</u>	<u>10,40,000</u>

4. (a) What are the assumptions of CVP analysis? 2
(b)

Per unit selling price	\$400
Per unit variable costs	\$150
Fixed costs	\$15,00,000
Units sold	\$2,600

12

Instructions:

- i. What is the amount of per-unit contribution margin?
- ii. What is the contribution margin ratio?

- iii. What is the break-even point in units and dollars?
 - iv. What is the margin of safety in units and dollars?
 - v. How many units are required to sell to earn profit \$1,00,000.
5. (a) At the end of its first month of operations, Watson Company has the following unadjusted trial balance. 14

WATSON Company, August 31, 2021 Trial Balance		
	Assets	Debit (\$)
		Credit (\$)
Cash	5,400	
Accounts receivable	2,800	
Supplies	1,300	
Prepaid Insurance	2,400	
Equipment	60,000	
Notes Payable		\$40,000
Accounts Payable		2,400
Owner's Capital		30,000
Owners drawing	1,000	
Service Revenue		4,900
Salaries Expense	3,200	
Utilities Expense	800	
Advertising Expense	400	
	<u>77,300</u>	<u>77,300</u>

Additional data:

- i. Insurance expires at the rate of \$200 per month.
- ii. \$1,000 of supplies are on hand at August 31.
- iii. Monthly depreciation on the equipment is \$900.
- iv. Interest of \$500 on the notes payable has accrued during August.

Instruction: Prepare a worksheet.

6. (a) Define "Event" and "Economic event". 2
- (b) Rose Valley is a licensed dentist. During the first month of operation of her business, the following events and transactions occurred: 12

- May 1 Invested Tk. 20,000 cash in her business.
- 1 Hired a secretary at a salary of Tk. 700 per week payable monthly.
- 2 Paid office rent for the month Tk. 1,100.
- 3 Purchased dental supplies on account from D Company Tk. 4,000.
- 10 Performed dental services and billed insurance companies Tk. 5,100.
- 11 Received Tk. 1,000 cash advance from a customer for an implant.
- 20 Received Tk. 2,100 cash for service performed.
- 30 Paid secretary for the month Tk. 2,800.
- 30 Paid Tk. 2,400 to D Company for accounts payable due.

Required: Prepare a tabular analysis of the May transactions.

7. (a) Explain the various types of "Adjusting Entries". 4
 (b) Terry Thomas opens the Green Thumb Lawn Care Company on April 1. At April 30, the trial balance shows the following balances for selected accounts. 10

Prepaid Insurance \$ 3,600

Equipment 28,000

Notes Payable 20,000

Unearned Revenue 4,200

Service Revenue 1,800

Analysis reveals the following additional data:

1. Prepaid insurance is the cost of a 2-year insurance policy, effective April 1.
2. Depreciation on the equipment is \$500 per month.
3. The note payable is dated April 1. It is a 6-month, 12% note.
4. Customers paid for the lawn service package of \$700 beginning in April. The company performed services for these customers in April.
5. Lawn services provided other customers but not recorded at April 30 totaled \$1,500.

Instructions: Prepare the adjusting entries for the month of April.

8. (a) Mr. Rahman started his own consulting firm, Rahman Consulting, on May 1, 2020. The following transactions occurred during the month of May. 14

- | | | |
|-----|----|--|
| May | 1 | Mr. Rahman invested Tk. 100,000 cash in the business. |
| | 2 | Paid Tk. 9,000 for office rent for the month. |
| | 3 | Purchased Tk. 6,000 of supplies on account. |
| | 5 | Paid Tk. 1,250 to advertise in the social media. |
| | 9 | Received Tk. 40,000 cash for services provided. |
| | 12 | Withdrew Tk. 10,000 cash for personal use. |
| | 15 | Performed services Tk. 60,000, 60% cash and 40% on account. |
| | 17 | Paid Tk. 25,000 for employee salaries. |
| | 20 | Paid for the supplies purchased on account on May 3. |
| | 23 | Received cash payment of Tk. 4,000 for services provided on account on May 15. |
| | 26 | Borrowed Tk. 50,000 from the bank on a note payable. |
| | 29 | Purchased office equipment for Tk. 4,200 on account. |
| | 30 | Paid Tk. 2,750 for utilities bill. |

Required: Journalize the above transactions.

Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

2nd Year 2nd Semester BSc (Engg.) Final Examination 2022

Course Title: Complex Variables and Fourier Analysis

Marks: 70

Course Code: ICT 2209

Time: 3 hours

Answer any 05 (FIVE). Maintain sequence while answering questions

- ✓ 1. (a) Define complex number. Write the polar form of a complex number $z = 1 + \sqrt{3}i$.
Describe the indicated operation of $(3 + 4i) + (5 + 2i)$ both analytically and graphically. 5
- (b) Determine the set of points in the complex plane which satisfy the following and represent graphically: $1 < |z - 2i| < 2$. 5
- (c) Give an example of a function $f(z)$ which is continuous at a point but not differentiable at that point; and prove it. 4
- ✓ 2. (a) Define analytic function. State and prove necessary condition for a function to be analytic. 6
- (b) Define harmonic function. Prove that the function $u = 2x(1 - y)$ is harmonic. Find a function v such that $f(z) = u + iv$ is analytic. Express $f(z)$ in terms of z . 5
- (c) Locate and name all the singularities of $f(z) = \frac{z^8 + z^4 + 2}{(z-1)^3(3z+2)^2}$. 3
- ✓ 3. (a) Define complex line integral. Evaluate the complex line integral
 $\int_{(0,1)}^{(2,5)} (3x+y)dx + (2y-x)dy$ along the curve $y = x^2 + 1$. 5
- (b) If $f(z)$ is analytic inside and on a simple closed curve C and a is any point inside C , then prove that $f'(a) = \frac{1}{2\pi i} \oint_C \frac{f(z)}{(z-a)^2} dz$. 5
- (c) Evaluate $\oint_C \frac{dz}{(z-4)(z-5)}$ around the circle $|z|=6$. 4
- ✓ 4. (a) If $f(z)$ is analytic inside and on a simple closed curve C except at a pole a of order m inside C , then prove that, the residue of $f(z)$ at a is given by
 $a_{-1} = \lim_{z \rightarrow a} \frac{1}{(m-1)!} \frac{d^{m-1}}{dz^{m-1}} \{(z-a)^m f(z)\}$. 3

4. (b) Find the residue of $f(z) = \frac{z^2 - 2z}{(z+1)^2(z^2 + 4)}$. 6

(c) Evaluate $\int_0^{2\pi} \frac{d\theta}{3 - 2\cos\theta + \sin\theta}$. 5

5. (a) Define Laplace transform. Find the Laplace transform of $t \sin 2t$. 5

(b) What do you mean by unit step function? Express the following function in terms of unit step functions and find its Laplace transform: $f(t) = \begin{cases} 8, & t < 2 \\ 6, & t > 2 \end{cases}$ 5

(c) Find the inverse Laplace transform of $\frac{1}{(s^2+1)(s^2+9)}$ and hence of the function $\frac{1}{(s^2+1)(s^2+9)}$. 4

6. (a) State and prove the convolution theorem for Laplace transform. 6

(b) Find the Laplace transform of the periodic function (saw tooth wave) from the following:

$$f(t) = \frac{kt}{T} \text{ for } 0 < t < T, \quad f(t+T) = f(t).$$

(c) Using the Laplace transform technique to solve the following initial value problem 5
 $y'' + 2y' + 2y = 5 \sin t$, where $y(0) = y'(0) = 0$.

✓ (a) What do you mean by Fourier series? Write down the Dirichlet's conditions. 8
Determine the co-efficient of Fourier series a_0, a_n and b_n over the interval $(-\pi, \pi)$.

(b) Define half range of Fourier series. Find the Fourier series of the following function: 6
 $f(x) = x + x^2$ in the interval of $-\pi \leq x \leq \pi$. Hence prove that $1 + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$.

8. (a) Define Fourier integral. What are the advantages of using Fourier transform? Find 7
Fourier sine and cosine transform of $f(x) = e^{-ax}$.

(b) Use Fourier sine transformation to solve $\frac{\partial U}{\partial t} = 3 \frac{\partial^2 U}{\partial t^2}$, where $U(0, t) = U(2, t) = 0; t > 0$ 7
and $U(x, 0) = x, 0 < x < 2$.

Mawlana Bhashani Science and Technology University

Department of Information and Communication Technology

2nd Year 2nd Semester BSc (Engg.) Final Examination 2022

Course Title: Computer Organization and Architecture

Marks: 70

Course Code: ICT 2201

Time: 3 hours

Answer any 05 (FIVE). Maintain sequence while answering questions

1. (a) Define cache memory. What are the fundamental differences between computer organization and computer architecture? 5
- (b) Define clock, and clock cycle. Write down the basic performance equation of time required to execute a program. 4
- (c) We want to compare the computers R1 and R2, which differ that R1 has the machine instruction for the floating-point operations, while R2 has not (FP operations are implemented in the software using several non-FP instructions). Both of the computers have a clock frequency of 400 MHz. In both, we perform the same program, which has the following mixture of commands: 5

Type of commands	Dynamic sharing of instructions in program (π_i)	Instruction duration (number of clock periods, CPI $_i$)	
		R1	R2
FP addition	16%	6	20
FP multiplication	10%	8	32
FP division	8%	10	66
Non-FP instructions	66%	3	3

2. calculate the MIPS for the computers R1 and R2

- (a) How are the memory locations addressed? Sketch the Big-Endian and Little-Endian 16-bit and 32-bit byte addressing assignments. 5
- (b) What is branching? How a loop instruction for adding n numbers can be executed in machine level using branching? 6
- (c) What are the addressing modes? Write at least 5 (five) addressing modes. Identify the addressing modes of the following instructions: 3

MOV AL, 35H
MOV AX, [BX]
ADD AX, [BX + SI]

3. (a) Write down the distinctions between index and relative addressing modes. 3
- (b) Perform the three (3) bit logical shift right (LshiftR), arithmetic shift right (AShiftR) and rotate shift right, without carry on the bit sequence 6

1 0 1 0 1 . . . 0 1 1

1

3. (c) Consider the following instructions for single-bus architecture:

5

MOV R8, [R9]

(i) Draw the timing diagram for this instruction.

(ii) Let the CW consists of PCin, PCout, MARin, Write, MDRout, IRin, Yin, Select, Add, Mov, Zin, Zout, R5out, R5in, R8out, WMFC, End, respectively. Write the microroutine for the full control sequence.

4. (a) Briefly explain floating point data representation with appropriate examples. 3

3

- (b) Write down the key distinctions between RISC and CISC processors. 4

4

- (c) Illustrate and briefly explain the architecture of ARM6 RISC processor. 7

7

5. (a) Illustrate and explain the basic features of Motorola 68881 coprocessor. 4

4

- (b) Explain, how can a n-bit parallel adder act as 2's complement adder-subtractor? 3

3

- (c) Represent the Robertson multiplication process, step-by-step, for multiplication process for multiplier, $X = 1011\ 0011$ and multiplicand, $Y = 1101\ 0101$. 7

6. (a) 'Overflow considers in all possible binary addition and subtraction' – Do you agree? 3
Explain with appropriate example(s).

3

- (b) Draw and explain the carry-lookahead adder and determine the equations to calculate the carry for up to 4 bits. 5

5

- (c) How is a product of multiplicand and multiplier determined in computer system? 6
Determine the necessary formulation of 2's complement multiplier which considers positive and negative numbers individually.

6

7. (a) What is hazard? Briefly explain the different types of hazards that are the main constraint to gain the expected pipeline performance. 5

5

- (b) Explain the concept of Single Instruction, Multiple Data (SIMD) architecture. 4

4

- (c) Briefly explain the accumulator-based CPU operations with the necessary diagram. 5

5

8. (a) Design a RAM memory of $1K \times 4$ using four 256×4 RAM memory. 5

5

- (b) Draw the internal organization of a $2M \times 8$ dynamic memory chip. 5

5

- (c) A computer has a single cache (off-chip) with a 2 ns hit time and, a 99% hit rate. Main memory has a 40 ns access time. What is the computer's effective access time? If we add an on-chip cache with a 0.5 ns hit time and a 94% hit rate, what is the computer's effective access time? How much of a speedup does the on-chip cache give the computer? 4