

Strong memory management

### Department of Information and Communication Engineering

Noakhali Science and Technology University

Term Final Examination, 2020

Year: 2, Term: II, Session: 2018-2019

Course Code: ICE-2201

Time: 4 Hours

Course Title: Programming with Java

Marks: 70

Answer any seven of the following questions.

**Marks**

1. (a) What are the advantages of using Java language over Procedure-oriented programming language? 3  
(b) Why is the Java language best known as a secured and robust programming language? Justify your answer. 3  
(c) How do you convert source code to bytecode in Java? Show the mechanism. 2  
(d) How FileNotFoundException and ArrayIndexOutOfBoundsException occurs then how can you handle them? Show with try-catch-finally statement. 2
2. (a) Compose a Java program to explain the encapsulation concept. 3  
(b) Create a Java program to check palindrome numbers and what is the meaning of class, public, static, void, main, String[] in your program. 5  
(c) What will be the output of following code ? 2

```
public class Test { String str3 = new String("Integers  
public static void main(String are not immutable");  
args[]) { int result = str1.compareTo(str2);  
String str1 = "Strings are System.out.println(result);  
immutable"; result = str2.compareTo(str3);  
String str2 = new System.out.println(result);  
String("Strings are immutable"); } }
```

3. (a) Define applet in Java. What are the differences between an applet and a standalone Java application? 3  
(b) Show Applet architecture. 2  
(c) What are the required steps for converting an application to an applet? Write them with an example in proper sequence. 3  
(d) Write the process for invoking an Applet and explain the following code with output. 2

```
<html>  
<title>The Hello, World Applet</title>  
<hr> <applet code = "HelloWorldApplet.class" width = "320" height =  
"120">
```

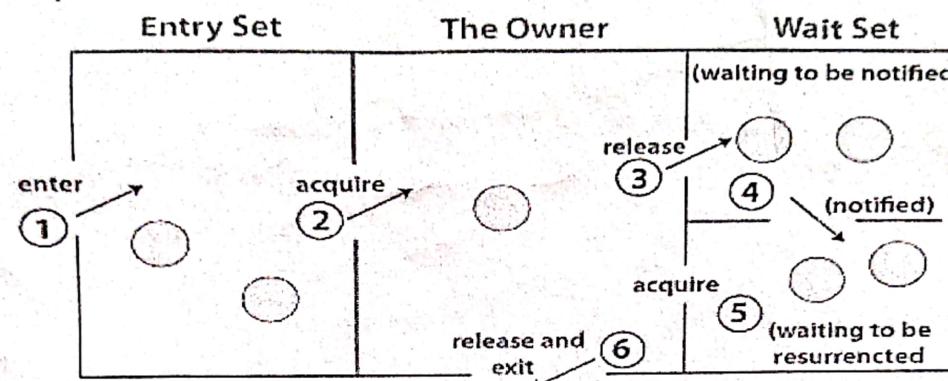
If your browser was Java-enabled, a "Hello, World" message would appear here.

```
</applet>
```

```
<hr> </html>
```

4. (a) Using string concatenation operator (+), construct a Java program to concatenate NSTU with ICE string. 3  
(b) How many methods are available in java to create a string object? Explain all methods with examples. 5  
(c) Differentiate between method overloading and method overriding in Java. 2

5. (a) Implement abstract class and interface with an appropriate Java program. 4  
 (b) What are the advantages of using exception handling in Java? Show the problem without exception handling and give the solution. 4  
 (c) Compose the syntax for nested try block. 2
6. (a) How can you prevent Deadlock in Java? Decide. 3  
 (b) Create a java program to get the IP address of www.nstu.edu.bd website. 3  
 (c) If you don't use Synchronization, what kind of problem will be created. Examine with an example. 4
7. (a) Write the list of methods and a little trick which makes thread communication. 2  
 (b) Write the rules for abstract class and method declaration. 3  
 (c) Explain the inter thread communication from the following figure. 3



- (d) Difference between wait and sleep methods? 2
8. (a) Distinguish between multithreading and multitasking in Java. 2  
 (b) Demonstrate the working procedure of Java OutputStream and InputStream. 4  
 (c) Illustrate the life cycle of a thread showing the different states involved with it. 4
9. (a) What is virtual method? What properties are necessary to use a virtual method? Explain. 3  
 (b) "Using the object of the subclass you can access the members of a super class". How? 3  
 (c) Write down different categories of java variables with example. 4

*Physical view* *logical*

### Department of Information and Communication Engineering

Noakhali Science and Technology University

Term Final Examination, 2020

Year: 2, Term: II, Session: 2018-2019

Course Code: ICE-2207

Time: 4 Hours

Course Title: Database Management Systems

Marks: 70

Answer any seven of the following nine questions.

Marks

1. (a) Define instance and schema. Describe the drawbacks of using file systems to store data. 4  
(b) Why do we need transaction management in DMBS? 2  
(c) Explain the concept of physical data independence, and its importance in database systems. 2  
(d) What are the five main functions of a database administrator? 2
2. (a) Consider a university database for the scheduling of classrooms for final exams. This database could be modeled as the single entity set exam, with attributes course-name, section-number, room-number, and time. Alternatively, one or more additional entity sets could be defined, along with relationship sets to replace some of the attributes of the examentity set, as 5  
i) course with attributes name, department, and c-number  
ii) section with attributes s-number and enrollment, and dependent as a weak entity set on course  
iii) room with attributes r-number, capacity, and building  
Design an E-R diagram illustrating the use of all three additional entity sets listed.
- (b) What is foreign key? Compare the cartesian product and natural join operation with an example. 5
3. (a) What are the different types of languages that are available in the DBMS? 2  
(b) Define weak Entity set. Give an example and explain why it is weak entity set. 3  
(c) What are the different levels of abstraction in the DBMS? Explain any two among these. 2+3
4. (a) List two reasons why null values might be introduced into the database. 2  
(b) What do you mean by integrity constraints? 2  
(c) Consider the given relational movie database. The data in this database is from the IMDB website. The database consists of following five tables. 6

ACTOR (id, fname, lname, gender)

MOVIE (id, name, year, rank)

DIRECTOR (id, fname, lname)

CAST (pid, mid, role)

MOVIE\_DIRECTOR (did, mid)

*id* column in ACTOR, MOVIE & DIRECTOR tables is a key for the respective table. CAST.pid refers to ACTOR.id, CAST.mid refers to MOVIE.id

MOVIE\_DIRECTOR.did refers to DIRECTOR.id and MOVIE\_DIRECTOR.mid refers to MOVIE.id

Now, write down the SQL query for the following questions.

- i. Delete all movies after 1980 and before 1991.
- ii. Find all actors who acted only in films before 1970.
- iii. Find the films with more women actors than men.
- iv. List all the movies that have the same year as the movie 'The Clay Bird'

- (2002)', but a better rank. (Note: bigger value of rank implies a better rank)
- v. List first name and last name of all the actors who played in the movie 'Jalal's Story (2015)'
- vi. List all directors in descending order of the number of films they directed
5. (a) What is data model? Which data model is best in your opinion and why? 1+3
- (b) What do you mean by Meta data? 2
- (c) Consider the following tables EMPLOYEE: 4
- | Emp_id | Emp_name | Salary |
|--------|----------|--------|
| 1001   | Rahim    | 12000  |
| 1002   | Mamun    | 10000  |
| 1003   | Rasel    | 15000  |
| 1004   | Sobus    | 13000  |
- i). Write a SQL Query to find highest salary.
- ii). Write a SQL Query to find second highest salary.
6. (a) Differentiate row level and statement level trigger. 2
- (b) Differentiate between generalization and specialization. 2
- (c) Make the distinction between disjoint and overlapping constraints. 2
- (d) Probably you know Cloud databases and Object-oriented databases. Can you compare these two along with their advantages, disadvantages and techniques? Discuss your answer. 1+3
7. (a) What are the two major pitfalls in designing a database schema and how these can be avoided? 3
- (b) Differentiate between the partial and total participation constraints with examples. 3
- (c) Discuss different types of the mapping cardinality for a binary relationship set R between entity sets A and B with example. 4
8. (a) Distinguish between 3NF and BCNF with appropriate examples. 2
- (b) Consider a relational schema  $R = \{A, B, C, D, X, Y\}$  and the decomposed table  $R1 = \{B, X\}$  and  $R2 = \{A, C, Y, D, X\}$  and  $FD = \{A \rightarrow B, C \rightarrow \{D, X\}, \{A, C\} \rightarrow Y\}$ . Decide whether the given decomposition of R, R1 and R2 is lossless or lossy decomposition? 4
- (c) Consider a relational schema  $R = (A, B, C, D)$  and functional dependencies:  $F = \{C \rightarrow D, C \rightarrow A, B \rightarrow C\}$ .
- Construct the best normal form that R satisfies.
  - Decompose R into a set of BCNF relations.
9. (a) Explain variable-length records using slotted page structure. 2
- (b) How can we calculate the Access time, Data-transfer rate and Mean time to failure (MTTF) for measuring the disk performance? Implement with example. 3
- (c) Define RAID and describe its level 0, 1 and 5. 5

**Noakhali Science and Technology University**  
**Department of Information and Communication Engineering**  
**Term Final Examination -2020**

**Course Code: ICE-2205**

**Session: 2018-2019**

**Total Marks: 70**

**Course Title: Algorithm Design and Analysis**

**Semester: 2<sup>nd</sup> Year 2<sup>nd</sup> Semester**

**Time: 4 Hours**

**Answer any of the following seven questions.**

**Marks**

- |   |
|---|
| <p>1. a) Define Algorithm. Is it necessary to design an algorithm before solving a problem? Why? What is the purpose of algorithm analysis? 2</p> <p>b) Consider the following list of n integer numbers: 6<br/> <math>A = [267, 965, 134, 456, 378, 887, 643, 25, 1088, \dots, 70]</math><br/>         This list is given to you and you are asked to find an element, for example, 888, from this list. Write an algorithm to accomplish this task. Perform the worst case analysis of your algorithm.</p> <p>c) What is Order of Growth of algorithms? 2</p> |
| <p>2. a) Write Selection Sort and Insertion Sort algorithms. Define different notations that are used in algorithm analysis and find those notations for both the sorting algorithms that you have written. Compare them based on the notations. 7</p> <p>b) What is space complexity? Are there any notations for space complexity like time complexity? What does it mean if we say that an algorithm has a running time of <math>\Theta(1)</math>? 3</p>   |
| <p>3. a) Differentiate between average case analysis and amortized analysis of algorithms. For which type of algorithms, amortized analysis is more useful than worst case analysis? Explain with an appropriate algorithm. 6</p> <p>b) "A measure of the performance of an algorithm is usually a function of its input size and the input size depends on the problem instance that translates to input in the context of algorithm that solves that problem"- Explain this with appropriate algorithm. 4</p>   |
| <p>4. a) Illustrate problem solving by induction using appropriate algorithm. 3</p> <p>b) Explain how mathematical induction technique can be applied to sort a list of numbers of Radix 10. Write the algorithm based on your explanation and analyze the algorithm to find its time and space complexity. 6</p> <p>c) What is tail recursion? 1</p>   |
| <p>5. a) Show how dynamic programming approach can solve a problem efficiently when sub problems generated after dividing that problem are overlapped. 3</p> <p>b) Explain how the matrix chain multiplication problem can be solved using dynamic programming approach. Write the algorithm and analyze it for getting different notations for time and space. 7</p>   |

6. a) Write the algorithm for fractional knapsack problem? How it is different than 0/1 knapsack? 3+1

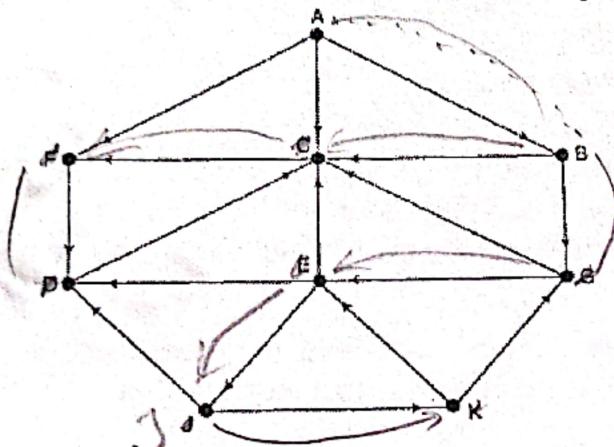
6. b) Assume that you have a knapsack with max weight capacity,  $W = 16$ . Now Fill the knapsack with items such that the benefit is maximum. Consider the following items and their associated weight and value.

ITEM	WEIGHT	VALUE
1	6	6
2	10	2
3	3	1
4	5	8
5	1	3
6	3	5

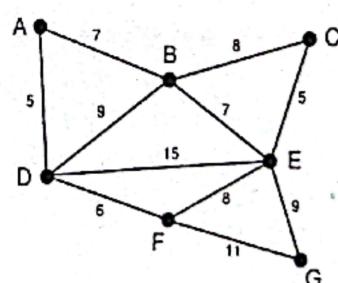
Now answer the below questions:

- i. Apply all the required steps will you follow to solve the problem.  
 ii. What items the optimal knapsack should carry to get the maximum benefit?

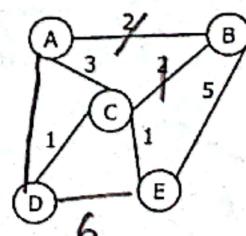
7. a) Find Breath First Search (BFS) and Depth First Search (DFS) for the below: 3+3



- b) Recursive definition of a problem makes the analysis easier- explain this statement. Write an algorithm to find out the Fibonacci number using recursion. 4
8. a) Write down the Kruskal's algorithm and then apply to find the minimum cost spanning tree for the below graph: 4+2



- b) First add the vertices A, D and vertices D, E. Assign weight values 7 to the first edge between A, D whereas assign 6 weight to the edge between D, E. Now Using Prim's algorithm, determine minimum cost spanning tree for the weighted graph shown below. 4



9. a) Describe Huffman Coding. What are the applications of it? 2  
 b) Suppose A through K; 11 data items stored as follows: 4

DATA	A	B	C	D	E	F	G	H	I	J	K
FREQ.	15	10	8	7	3	12	11	9	4	5	6

- i) Construct a Huffman tree with generated Huffman code  
 ii) Calculate Message original and compressed bit.

- c) Find out the values for row =5 and 6. And write an algorithm which can generate cell value for the rows automatically. 4

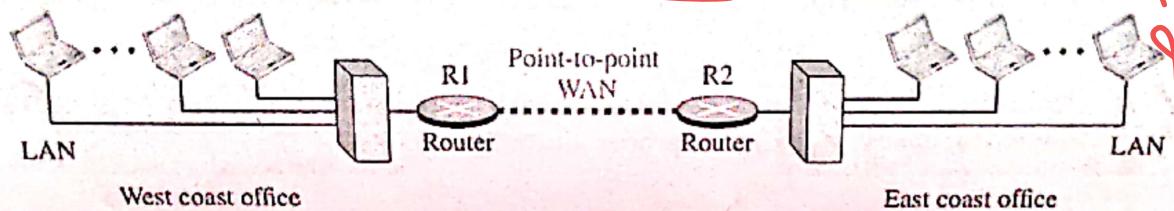
1  
 0 2 1 0 1  
 0 2 2 2 3  
 0 2 2 4 4 3 4 5  
 0 2 2 4 6 4 5 6 7  
 0 2 2 4 6 8 10 12 13 14 15  
 0 2 2 4 ? ? ? ? ? ? ? ? ? ? 10 11

Time: 4 Hours

Total Marks: 70

[Answer any seven of the following questions. Figures in the right margin indicate full marks]

1. a) What is data communication? Explain the components of a data communication system. 2+2  
 b) What are the differences among simplex, half-duplex and full-duplex mode? 3  
 c) An analog signal has a bit rate of 8000 bps and a baud rate of 1000 baud. How many data elements are carried by each signal element? How many signal elements do we need? 3
2. a) Using the following figure, show the layers of the TCP/IP protocol suite and the flow of data when two hosts, one on the west coast and the other on the east coast, exchange messages. 5  
 The figure represents an internetwork made of two LANs and one point-to-point WAN.



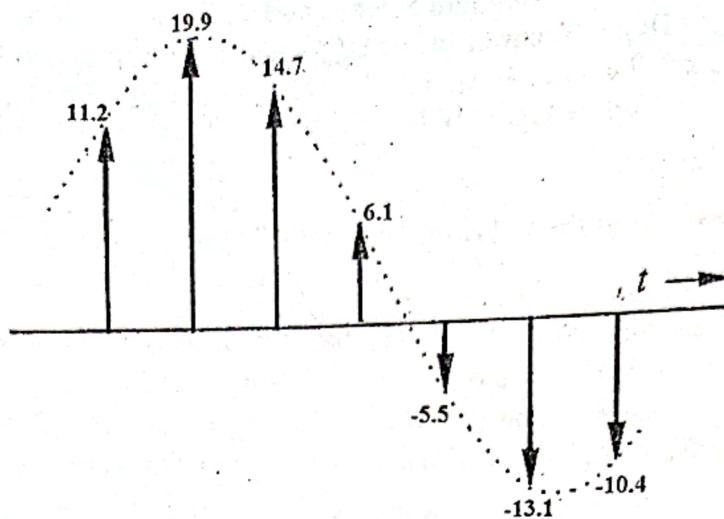
- PLX & SD
- b) What is "Logical Connection" between layers? Show the logical connections between the layers of TCP/IP protocol suite. 3
  - c) "Without Protocol Layering, data communication is impossible", - do you agree with this statement? Explain your answer. 2

3. a) Demonstrate the techniques that decomposes a composite signal into its individual frequencies. ~~DMX process~~ 4  
 b) Create a diagram that represents the steps of modulation of a digital signal for transmission on a bandpass channel. 4  
 c) If a periodic signal is decomposed into five sine waves with frequencies of 100, 300, 500, 700 and 900 Hz, what is its bandwidth? Draw the spectrum, assuming all components have a maximum amplitude of 10 V. 2

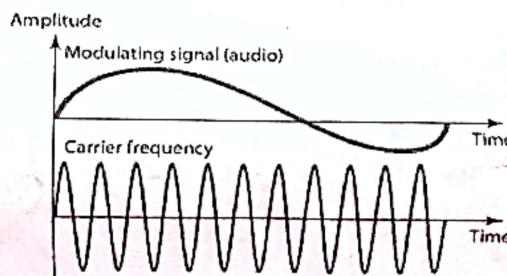
4. a) Why data rate limits over a channel? Explain Shannon Capacity formula. 3  
 b) What are the differences between propagation time, transmission time and queuing time? 3  
 c) What will happen when you send your data through a channel that has 0 SNR? 2  
 d) A network with bandwidth of 10 Mbps can pass only an average of 12,000 frames per minute with each frame carrying an average of 10,000 bits. What is the throughput of this network? 2

5. a) Describe the three techniques of digital-to-digital conversion. 3  
 b) Define the following and its effect on digital transmission  
 (i) Baseline Wandering (ii) DC Component (iii) Self-synchronization 3  
 c) Draw digital signal encoding format for the following latter codes for binary input 01001100011  
 (i) NRZ-L (ii) NRZ-I (iii) Bipolar-AMI (iv) Pseudoternary (v) Manchester (vi) Differential Manchester. 4

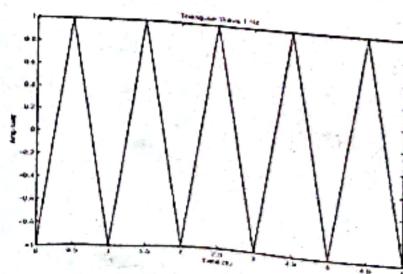
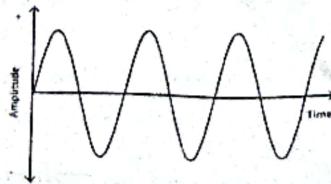
6. a) Assume that we have a sampled signal with only seven samples using ideal sampling in which the sample amplitudes are between -20 and +20 V. If we choose eight quantization levels ( $L = 8$ ) then construct the quantization steps and encoding of this sampled signal. The value at the top of each sample in the graph shows the actual amplitude. 5



- b) Classify and describe three serial transmission techniques with their natural application. 3
- c) A telephone subscriber line must have an  $SNR_{dB}$  above 40. What is the minimum number of bits per sample? 2
- a) Demonstrate the frequency modulated signal for the given modulating (message) signal and carrier frequency (signal) with proper illustrations. 4

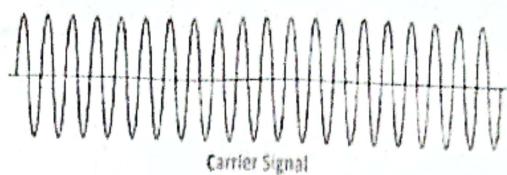


- b) Explain the concept of a constellation diagram. Show the constellation diagrams for ASK (OOK), BPSK and QPSK signals. 2
- c) You have an available bandwidth of 100 kHz which spans from 200 to 300 kHz. What should be the carrier frequency and the bit rate if you modulated your data by using ASK with  $d = 1$ ? If you modulate your data by using FSK, what would be the value of carrier frequency and bit rate? Explain the reasons for your answers. 4
- 8 a) You need to send data 3 bits at a time at a bit rate of 3 Mbps. The carrier frequency is 10 MHz. Calculate the number of levels, the baud rate and the bandwidth. Draw the figure of the allocation of frequencies and bandwidth. 2+2
- b) What do you mean by Amplitude Modulation? Demonstrate the amplitude modulated signals for the given modulating (message) signals and carrier frequency (signal) with proper illustrations. 1+5



(a) Modulating Signals

Time Domain



(b) Carrier Signal

- ✓ a) Discuss the comparison among radio wave, microwave and infrared by means of advantages, disadvantages and application. 4
- b) What are the differences between STP and UTP cables? 3
- c) What do you mean by fiber optic cable? Explain the advantages and disadvantages of optical fiber. 3

Department of Information and Communication Engineering

Noakhali Science and Technology University

Term Final Examination, 2020

Year: 2, Term: II, Session: 2018-2019

Course Code: ICE 2209

Course Title: Electromagnetic fields and waves

Time: 3 Hours

Marks: 70

2018 ECO

Answer any seven of the following questions.

Marks

1. (a) Why electromagnetic field theory is essential for communication? How communication can be established between moving telephone units? 2+3
- (b) Suppose  $\mathbf{A}$  is a vector. Now illustrate the vector in cartesian, cylindrical and spherical coordinates. 5
2. (a) Suppose  $\mathbf{A}$  is a vector. Now illustrate the vector in cartesian, cylindrical and spherical coordinates. 5
- (b) Deduce and proof Stoke's theorem. 5
3. (a) A dipole is placed on an electric field. Show that its torque ( $\tau$ ) and potential energy ( $U$ ) can be represented by the cross and dot products of moments ( $\mathbf{P}$ ) and fields ( $\mathbf{E}$ ). 5
- (b) For a spherical capacitor, prove that capacitance is only a function of two radii. 5
4. (a) What is the limit of amperes law? Deduce coulomb's law from Gauss's law. 1+4
- (b) How magnetic flux linkage can be measured? For a coaxial transmission line having a solid inner conductor of radius 'x', and a thin outer conductor of radius 'y'. Calculate the total flux linkage per unit length. 1+4
5. (a) Write down four Maxwell equations in differential form and explain their significance in your own words. 4
- (b) Prove that in free space electromagnetic waves travels as the same velocity as light. 6
6. (a) Electromagnetic radiation from the sun travels to the earth with an intensity of  $1500 \text{ W/m}^2$ . If we are considering a single electromagnetic wave, find the value of peak electric and magnetic fields. 4
- (b) Define phase velocity, group velocity, TEM waves. 3
- (c) What do you mean by intrinsic impedance of a medium? What is the value of the intrinsic impedance of a good conductor? 3
7. (a) A uniform plane wave propagates in the X direction. Mathematically show that it has no X component of  $\mathbf{E}$ . 4
- (b) Evaluate  $120\pi$  as the characteristic's impedance of the free space. 6
8. (a) Explain the four functional parameters (attenuation constant, phase constant, intrinsic impedance, phase velocity) for the case of low loss dielectrics. 6
- (b) The electric field intensity of a linearly polarized uniform plane wave propagating in the  $+z$  direction in seawater is  $\mathbf{E} = a_x 100 \cos(10^7 \pi t) \text{ V/m}$  at  $z=0$ . The constitutive parameters of seawater are  $\epsilon_r=72$ ,  $\mu_r=1$  and  $\sigma=4 \text{ S/m}$ . Determine the attenuation constant, phase constant, intrinsic impedance and phase velocity. 4
9. (a) State Gauss's law for magnetism. Show that self-inductance of a circular coil,  $L = (\pi \mu N^2 r)/2$  2+3
- (b) If a boundary surface stays in between two media, show that tangential component of electric field is continuous at boundary 5

**Department of Information and Communication Engineering  
Noakhali Science and Technology University  
Term Final Examination-2020, Year-2, Term-II  
B.Sc. (Eng.), Session: 2018-2019, December'2021**

**Course Code: Math-2211 Course Title: Laplace, Fourier series and Complex Variables**

**Time: 4 hours**

**Total Marks: 70**

**(Answer any Seven of the following questions. The right hand margin indicates full marks)**

1(a)	Identify Complex number. Prove that $ Re(z)  +  Im(z)  \leq \sqrt{2}  z $ , where $z$ is any complex number.	4
1(b)	Find two complex numbers whose sum is 4 and whose product is 8.	4
1(c)	If the product of two complex number $z_1$ and $z_2$ is real then show that $z_1 = p \bar{z}_2$ , where $p$ is real number.	2
2(a)	Evaluate the following region geometrically $ z + 2 - 3i  +  z - 2 + 3i  < 10$ .	5
2(b)	Define continuous function. Prove that the function $f(z) =  z ^2$ is continuous everywhere but not where differentiable except at the origin.	5
3(a)	Derive the necessary and sufficient condition for the function $w = f(z)$ is analytic	7
3(b)	Determine the following function $u$ is harmonic or not: $u(x,y) = x^2y + 2x^2 - y^3 - 4y^3$ .	3
4(a)	State and prove Green's theorem in the plane	5
4(b)	Verify the truth of Green's theorem in the plane for $\oint_C (2xy - x^2)dx + (x + y^2)dy$ , where $C$ is the closed curve of the region bounded by $y = x^2$ and $y^2 = x$	5
5(a)	State and prove Cauchy's Integral formula for a complex valued function with $n$ -derivative	6
5(b)	Find the residue of the following function $f(z) = \frac{z^2 - 2z}{(z+1)^2(z^2 + 4)}$	4
6(a)	Interpret the Laplace Transform (L. T). Write some properties of Laplace Transform.	3
6(b)	Justify the applications of Laplace Transform in Science and Engineering fields.	4
6(c)	What do you mean by inverse Laplace Transform? Find the value of $L^{-1} \left\{ \frac{6}{2s-3} - \frac{3+4s}{9s^2-16} + \frac{8-6s}{16s^2+9} \right\}.$	3
7(a)	An inductance of 3 henry, a resistor of 16 ohms and a capacitor of 0.02 farad are connected in series with an emf of 300 volts. At $t = 0$ , the charge on the capacitor and current in the circuit is zero. Find the charge and current at any time $t > 0$ and also draw the circuits.	6
7(b)	Applying the Laplace transform of second derivative, prove that	4

	(i) $L\{\sin at\} = a/a^2 + s^2, s > 0$ (ii) $L\{\cosh at\} = s/s^2 - a^2, s >  a $	
8(a).	Define Fourier Series. State and prove Fourier integral theorem.	5
8(b).	Write the Dirichlet's conditions. Given that $f(x) = x + x^2$ for $-\pi < x < \pi$ , find the Fourier expression of $f(x)$ . Deduce that $\pi^2/6 = 1 + 1/2^2 + 1/4^2 + \dots$	5
9(a).	What is finite Fourier sine transformation? Find the finite Fourier Sine transform of $F(x)$ , where $F(x) = \begin{cases} x, & 0 \leq x \leq \pi/2 \\ \pi - x, & \pi/2 \leq x \leq \pi \end{cases}$	4
9(b).	Judgment the Fourier Cosine transform of $e^{-x^2}$ .	4
9(c).	Outline the Laplace transform of $t^2 e^{-2t} \cos t$ .	2