Noakhali Science and Technology University
Department of Information and Communication Engineering
Year 3, Term I **Session: 2018-19**
Course Code: ICE-3107 **Course Title: Signals and Systems**
Time: 4 hours **Total Marks: 70**

[Answer any seven set questions from the following nine set questions] **Marks**

1. a) Distinguish between signal and system with example. What are the necessities of signal and system course for you as an engineer? 4
   b) Show that any arbitrary signal can be expressed as the sum of even and odd components. 3
   c) Explain the following signal properties with proper figures, 3
      i) Exponential signal
      ii) Unit ramp signal
      iii) Rectangular signal

2. a) What do you understand by periodicity of any signal? Determine the periodicity the following signal. If the signal is periodic, determine its fundamental period. 4
      i. $x(t) = sin^2 t$
      ii. $x[n] = e^{j(\frac{\pi}{4})n}$

   b) Distinguish between energy signal and power signal. Determine whether the following signals are energy signals, power signals, or neither. 4
      i. $x(t) = tu(t)$
      ii. $x[n] = (-0.5)^n\, u[n]$

   c) Define deterministic and non-deterministic signal. 2

3. a) The impulse response of a LTI system is $h(n) = \{1, \underset{\uparrow}{2}, 1, -1\}$. 4
      Determine the response of the system to the input signal $x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$.

   b) Explain causality and stability of a linear time invariant (LTI) system. Find out the stability of the following signals: 4
      i. $y(t) = \int x(t)$
      ii. $y(t) = \frac{d}{dt}x(t)$

   c) Sketch the following signals 2
      i. $u(-t)e^{-3t}$
      ii. 3 rect $(\frac{2t}{T})$

4. a) Determine whether the corresponding system is linear, time invariant or both. 5
      i. $y(t) = t^2\, x(t-1)$
      ii. $y[n] = x[n+1] - x[n-1]$

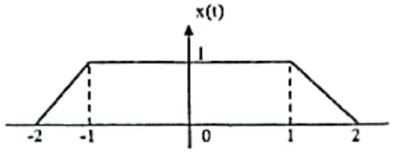
   b) Define invertible and non-invertible system. Determine if each of the following systems is invertible? If the system is invertible, give the inverse system. 5

   (i) $y(t) = 2x(t)$

   (ii) $y(t) = x^2(t)$

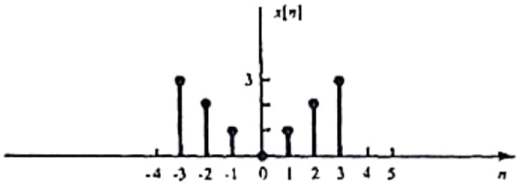
   (iii) $y(t) = \int_{-\infty}^{t} x(\tau)d\tau$

5. a) Explain Static and Dynamic system with example. 3
   b) Determine the total energy and power of the signal shown in the following figure. 4



   c) A discrete-time signal $x[n]$is shown in the following figure. Sketch and label each of the following signals. 3

   i. $x[n]\,u[1-n]$
   ii. $x[n]\,\{(u[n+2]-u[n])$
   iii. $x[n]\,\delta[n-1]$



6. a) What is Fourier series and why do we use it? 2
   b) How can continuous time periodic signal be represented by the Fourier series? Explain it. 5
   c) For the continuous time periodic signal $x(t) = 2 + \cos\left(\frac{2\pi}{3}t\right) + 4\sin\left(\frac{5\pi}{3}t\right)$ determine the fundamental frequency ω_0 and the Fourier series coefficients a_k. 3

7. a) Why do we use Fourier transform for signal analysis? 2
   b) Describe the Fourier transform representation of the continuous-time aperiodic signal. 4
   c) Consider the continuous-time signal $x(t) = e^{-at}u(t)$; *where* $a > 0$. Find Fourier transform of this signal. 4

8. a) Derive the Fourier transform of the discrete-time aperiodic signal. 4
   b) Consider the discrete-time signal $x[n] = a^{|n|}$; *where* $|a| < 1$. Find Fourier transform of this signal. 3
   c) What are the differences between Fourier series and Fourier transform? 3

9. a) Where do we use Laplace transform, and why is it important? 3
   b) Derive the Laplace transform for the complex exponential signal. 4
   c) What are differences between Laplace transform and Z-transform? 3

$$\delta(t) = \begin{cases} 1 & t=0 \\ 0 & t\neq 0 \end{cases}$$

$$\int \delta(t) = u(t)$$

Noakhali Science and Technology University
Department of Information and Communication Engineering
Year 3, Term I **Session: 2018-19**
Course Code: ICE-3101 **Course Title: Microprocessor and Interfacing**
Time: 4 hours **Total Marks: 70**

[Answer any seven set questions from the following nine set questions] **Marks**

1. a) Define Microprocessor. Describe Von Neumann architecture with block diagram. 3
   b) What will happen when a PC is powered on? 2
   c) Describe "Hardware-Retriggerable One-Shot" mode of 8254 counter and its application. 5

2. a) What is the role of clock in Microprocessor? 2
   b) Explain the function of various flags of 8086 microprocessor. 4
   c) Describe any five addressing modes of 8086 with suitable examples. 4

3. a) Draw and discuss the internal block diagram of 8086. 6
   b) What is the function of a segment register in 8086? 2
   c) Write down the difference between 8085 and 8086 microprocessor. 2

4. a) What will be the output of the status flags after executing the instruction: 5
   SUB AX,BX where AX=FEEFH and BX=1F8EH
   b) What is unknown value for each of the following physical address? 2
   (i) A000H : ? = A0123H (ii) ? : CD21H = 32D21H
   c) Explain the difference between the following instructions: 3
   MOV AX,2378H and MOV AX,[2378H].

5. a) A single-error detecting and correcting Hamming code words 1001100111010 is received from DRAM. Is the word received correctly? If not find which bit in error? Also find out the data word. 6
   b) What are the differences among INTR, INTA and NMI pin function of 8086 microprocessor? 2
   c) Why the INTR input is automatically disabled as part of the response to an INTR interrupt? 2

6. a) Describe the architecture of 8087 with figure. 5
   b) Describe Status Register, Control Register and Tag Register. 5

7. a) What is Direct Memory Access (DMA)? Why is DMA data transfer faster than doing the same data transfer with program instruction? 3
   b) What are the advantages and disadvantages of DMA controller? 3
   c) Describe different bus system with diagram in a microcomputer. 4

8. a) What is interrupt vector table? Write the working principle of interrupt vector table by a microprocessor. 4
   b) Describe any two types of 8086 interrupt with example. 4
   c) Difference between memory mapped I/O and I/O mapped I/O. 2

9. a) Write short note on Flash ROM and Shadow RAM. 4
   b) Describe the maximum mode pin functions of 8086 microprocessor. 4
   c) What is the purpose of using co-processor? 2

Noakhali Science and Technology University
Department of Information and Communication Engineering
Year 3, Term I Session: 2018-19

Course Code: ICE-3109 Course Title: Peripheral Interfacing and Embedded System

Time: 4 hours Total Marks: 70

[Answer any seven set questions from the following nine set questions]

			Marks
1.	a)	Let us assume, ATM both is a kind of automatic embedded system, according to you, how it works with its external environment. You must provide a proper illustrative diagram of ATM network.	4
	b)	Show a proper diagram of computer and target processor connection in case of system development process. Then describe the procedure according to your own understanding.	3
	c)	How NRE cost affects the whole design of a general purpose processor? Describe the phenomenon with other characteristics. Then represent a diagram of general purpose processor with its parts.	3
2.	a)	Write down the comparisons among ASIC, PLD, PLA, FPGA technologies.	5
	b)	Describe Steps involved in designing sequential logic circuits with following problem description: To design a clock divider, slow down your preexisting clock so that you output a 1 for every 4 cycles. There are three inputs x, y, z and 2 outputs S, T. [Condition: S = 1 if x= 1 or y and z = 1; T = 1 if y or z = 1, but not both]	5
3.	a)	Compare between General-purpose processor and Customized Single-purpose processor.	4
	b)	Given a clock frequency of 10 MHz, determine the number of clock cycles corresponding to a real-time interval of 100 ms.	2
	c)	How it is possible to concatenate multiple memory ICs to extend its capacity? Describe briefly all possible techniques.	4
4.	a)	What are the four main design metrics that can be competitive with each other? Describe them.	3
	b)	Write a list of popular approaches for improving the design process. Then describe any one of them.	3
	c)	In a specific ROM fabrication, it is required to inject electrons into the floating gate, using higher than normal voltage (usually 12V to 25V) that causes electrons to "tunnel" into the gate. The technique is called_____. Write the techniques with its advantages and disadvantages.	4
5.	a)	What do you understand by vectored interrupt?	1
	b)	Consider, a microprocessor has one interrupt pin, say *IntReq*, which any peripheral can assert. After detecting the interrupt, the microprocessor asserts another pin, say *IntAck*, to acknowledge that it has detected the interrupt and to request that the interrupting peripheral provide the address where the relevant ISR resides. What type interrupts will be used in here? Describe its functionalities with appropriate diagram.	5
	c)	"A microprocessor may use one of two methods for communication over a system bus". What are they? Write short notes of them.	4
6.	a)	Design and explain a system to perform peripheral to memory transfer with DMA.	6
	b)	What is programmable interrupt controller and what is its use?	4

7. a) Write some existing features of flash memory. 3
b) What are the differences between PROM and EPROM? 3
c) How can you design an EEPROM memory structure? Explain with diagram. 4

8. a) Show a state diagram for general Elevator. 3
b) If Alex has a Cake production factory and he control the works of his factory with a computer system then which type of system can be used? Describe the system briefly. 5
c) 2

```
#include<stdio.h>

int main (){ int i, j;

for(i=2; i<100; i++){

for(j =2; j <= (i/j); j++)

if(!(i%j)) break;

if(j >(i/j)) printf("%d is prime\n",i); }

return 0; }
```

Show a state diagram for the above program.

9. a) What are the building units of SRAM? Why SRAM is faster than others? 2
b) If a good number of input/output devices are attached to the computer then how priority interrupt will work? 4
c) Show a diagram for illustrating diagram for daisy chain priority interrupt and explain it. 4

Department of Information and Communication Engineering
Noakhali Science and Technology University
Term Final Examination: 2021
B.Sc. (Honors), Session: 2018-2019
Year-3, Term-I, Course Code: MATH-3113
Course Title: Statistics

Time: 4 Hours Marks: 70

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

1(a)	What do you mean by statistics? Distinguish between (i) population and sample, (ii) primary data and secondary data.	5
1(b)	Show that $\sum_{i=1}^{k} f_i(x_i - A)^2 > \sum_{i=1}^{k} f_i(x_i - \bar{x})^2$	5
2(a)	Find (i) Geometric mean (ii) Mode (iii) Median (iv) P_{95} and (v) Standard deviation for distribution	5

Values	Frequency
0-20	17
20-40	31
40-60	37
60-80	23

2(b)	What are the frequently used measures of dispersion? Briefly describe them. Also, establish relation between central moment and raw moments.	5
3(a)	Define Mathematical expectation. State and prove additive law of expectation for discrete and continuous variables.	5
3(b)	Establish the relation $\beta_2 \geq \beta_1 + 1$ and $\beta_2 \geq 1$, where each symbol contains its usual meaning.	5
4.	A department store has the following statistics of sales (X) for a period of last one year of 10 salesmen, who have varying years of experience (Y).	10

Years of experience	Annual Sales (in thousands)
1	81
3	93
3	102
4	99
6	103
8	111
10	123
11	117
11	127
13	135

(i) Find correlation between years of experience and sales.
(ii) Find the regression line of Y on X and hence predict annual sales volume of persons who have 12 and 17 years of experience.

Turn over

5(a)	A box contains 7 red balls and 3 blue balls. If 5 balls are selected at random without replacement, obtain the probability distribution table for the number of red balls drawn. Also, determine the corresponding probability distribution function.	4
5(b)	Define moment and cumulant regarding mathematical expectation. Find the constant y_0 and hence geometric, harmonic mean and standard deviation of the following density function: $f(x) = y_0(x - x^2), 0 < x < 1.$	6
6(a)	Define binomial distribution with examples. Also, derive properties of binomial distribution (which includes mean, standard deviation, skewness, and kurtosis).	6
6(b)	Fit a binomial distribution to the following data which refer to number of heads obtained by 200 times repeated toss of five coins:	4

No. of heads	0	1	2	3	4	5	Total
Frequency	12	56	74	39	18	1	200

7(a)	Define normal distribution with properties. Find the moment generating function (MGF) of the normal random variable having the mean μ and variance σ^2. Use this MGF to obtain the first four moments of the normal distribution and hence obtain skewness β_1 and kurtosis β_2.	6
7(b)	If X is a normal variate with mean 25 and variance 9, find k such that (i) 30% of the area under the normal curve lies to the left of the distribution (ii) 15% of the area under the normal curve lies to the right of the distribution	4
8(a)	Define hypothesis testing, level of significance, p-value and confidence interval. Also, describe the pairs: (i) Null hypothesis and alternative hypothesis (ii) Type I error and Type II error (iii) one-tailed and two-tailed hypothesis (iv) critical/rejection region and acceptance region.	6
8(b)	The mean and standard deviation of scores obtained from a random sample of 40 university students were 2.8 and 0.35 respectively. Can you conclude that the mean score of the entire university student group (from which the random sample is taken) is 2.4? Use a 1% level of significance and compute 99% confidence interval for the mean score in the population.	4
9(a)	In an experiment with immunization of goats from anthrax the following results were obtained. Derive your inference on the vaccine.	5

	Died	Survived
Inoculated	2	10
Not inoculated	6	6

9(b)	For the 2×2 contingency table whose cell frequencies are:	5

a	b
c	d

Show that the value of χ^2 for testing independence is given by $\chi^2 = \frac{n(ad-bc)^2}{(a+b)(b+d)(c+d)(c+a)}$ where $n = a + b + c + d$.

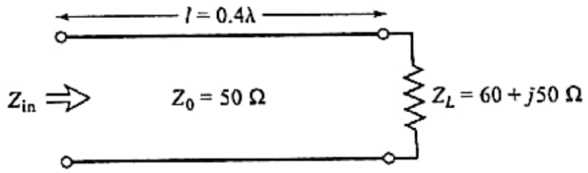
Noakhali Science and Technology University
Department of Information and Communication Engineering
Year 3, Term I **Session: 2018-19**
Course Code: ICE-3103 **Course Title: Microwave Engineering**
Time: 4 hours **Total Marks: 70**

[Answer any seven set questions from the following nine set questions] **Marks**

1. a) Define microwave engineering. Depicts the reasons for using microwave frequency spectrum. 3
   b) Why are microwave frequencies of interest? What are the characteristics of terrestrial microwave? 1.5+1.5
   c) What is Diversity? Explain different types of diversity with figures. 4

2. a) Briefly explain the components of microwave communication. 2
   b) Draw the block diagram of microwave communication with the presence of transmitter and receiver. 3
   c) Describe bending of ray paths bent due to atmospheric refractivity gradient. 5

3. a) What is cut-off wavelength? Explain different propagation modes and cutoff frequency. 5
   b) Use the Smith chart to find the following quantities for the transmission line circuit shown in the accompanying figure: 5
      i. The SWR on the line.
      ii. The reflection coefficient at the load.
      iii. The input impedance of the line.
      iv. The distance from the load to the first voltage minimum.
      v. The distance from the load to the first voltage maximum.



[Smith chart must add to the answer script.]

4. a) Demonstrate microwave receiver noise level and system noise. 5
   b) A microwave LOS link at 15 GHz is to be designed for communication over a distance of 12 km. If the diameters of the dishes at two ends of the link are the same and equal to 4 m, calculate the transmitter power required when the receiver noise figure at the receiving end is 10 dB, receiver bandwidth is 2 GHz and the C/N ratio is required to be 50 dB. 5

5. a) Compare the advantages and disadvantages of coaxial cables and two wire transmission lines. 4
   b) Classify the different types of waveguide. Compare the differences between waveguide and transmission line. 4
   c) State the principal advantage of microwave frequencies over lower frequency. 2

6. a) What are transmission lines in microwave communication? Briefly explain the relationship between impedance and admittance. 4
   b) Define waveguides. List some advantages and disadvantages of waveguides. 4

c) Explain the boundary conditions of a waveguide. 2

7. a) State the word statement of the Maxwell equations. 2
b) What is the dominant mode of the waveguide? Demonstrate the mode numbering system of a rectangular and circular waveguide. 4
c) Illustrate the modes of operation of a waveguide. 4

8. a) Give an explanation of measurements of low power in microwave communication. 3
b) Interpret the technique of measuring the phase shift of the microwave. 3
c) A transmission system using a TE_{10} mode waveguide of dimensions a=6 cm, b=3 cm is operating at 15 GHz. The distance measured between two minimum power points is 2 mm on a slotted line. Calculate the VSWR of the system. 4

9. a) State four major factors that influence maximum range of a radar and also write down some applications of radar. 5
b) Consider a radar pulse waveform in which peak power p_t =1MW, pulse width τ = 1 μs and pulse repetition period Tp = 1 ms. Find (i) Maximum unambiguous range (ii) Average power (iii) Duty cycle and (iv) Energy of the pulse. 5

Noakhali Science and Technology University
Department of Information and Communication Engineering
Year 3, Term I **Session: 2018-19**
Course Code: ICE-3105 **Course Title: Operating System**
Time: 4 hours **Total Marks: 70**

[Answer any seven set questions from the following nine set questions] **Marks**

1. a) Define Operating system. Describe the computer system operation. 1+2
   b) Define Kernel. Draw the storage-device hierarchy. 1+1
   c) Describe the differences between symmetric and asymmetric multiprocessing. 2
   d) Define multiprocessor. Describe the advantages of multi processor systems. 1+2

2. a) Determine what will happen if we don't use operating system in our computers? List all the advantages and disadvantages if there are any. 3
   b) Why dual mode is existent in an operating system? Does all the operating system consist of dual mode? Name one OS with and without dual mode if there is any. 4
   c) What are the three main purposes of an operating system? State their importance. 3

3. a) Describe Peer-to-peer computing and cloud computing. 3
   b) Describe the transition from user to kernel mode operation. 2
   c) Define thread. What are the benefits of multithreaded programming? 1+2
   d) Distinguish between process and program. 2

4. a) What is PCB? Describe the contents of a Process Control Block (PCB). 1+2
   b) Describe queueing-diagram representation of process scheduling. 3
   c) A parent may terminate the execution of one of its children. What are the reasons? 2
   d) Why are the programs and data not resided in main memory permanently? 2

5. a) Explain how an operating system's user view can be different from the system view. 4
   b) Describe with the aid of a diagram the life-cycle of a process. You should describe each of the 5 states that it can be in, and the reasons why it moves between these states. 4
   c) Define critical section and race condition in operating system. 2

6. a) Consider the following set of process with the length of the CPU burst time given in milliseconds: 6

Processes	Arrival time	Burst Time
P1	0	10
P2	1	29
P3	2	3
P4	3	7
P5	4	12

   The processes are assumed to have arrived in the order P1, P2, P3, P4, and P5. Consider the SJF, and RR (quantum = 4 milliseconds) scheduling algorithms for this set of processes. Draw four Gantt charts that illustrate the execution of these processes. Which algorithm would give the minimum average waiting time?
   b) What are deadlocks? Write down the conditions with brief note to hold deadlocks in a system. Justify your answer if it is possible to have a dead lock involving only one process. 4

7. a) Find the average waiting time (A.W.T.) and the average turnaround time (A.T.A.T.) for executing the following processes using round-robin algorithm, where time quantum is 5. 3

Process	Arrival Time	Burst Time
P1	5	11
P2	0	4
P3	0	14
P4	1	9
P5	2	21

b) Describe about resource-allocation graph with example. 2

c) What are the main difference between a network operating systems and distributed operating systems? 2

d) What are the major issues in designing a distributed operating system? 3

8. a) How does DMA increase system concurrency? How does it complicate hardware design? 3

b) Describe several data structures that must be maintained to implement the banker's algorithm. 2

c) Consider a system with five processes P_0 through P_4 and four resource types A, B, C and D. Suppose that, at time T_0, the following snapshot of the system has been taken: 5

	Max				Allocation				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P_0	0	0	1	2	0	0	1	2	1	5	2	0
P_1	1	0	0	0	1	7	5	0				
P_2	1	3	5	4	2	3	5	6				
P_3	0	6	3	2	0	6	5	2				
P_4	0	0	1	4	0	6	5	6				

(i) What are the contents of the Need matrix?
(ii) Is the system in a safe state? Why
(iii) If a request from process *P1* arrives for (0,4,2,0), can the request be granted immediately? Show the new system state and other criteria.

9. a) Define paging. Explain a paging with a model of logical and physical memory. 3

b) Consider the following page reference string: 4
7,0,1,2,3,0,4,0,2,3,0,3,2,1,2,0,1,7,0,1
How many page faults will occur for the LRU page replacement algorithm assuming availability of **four** frames?

c) In a demand paging system, what are the factors that can be taken into account when deciding which valid page should be made a victim? 3