Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2017
Session: 2015-2016 & 2014-2015

Course Code: **ICE-2201** Course Title: **Data Structure and Algorithm**

NB:
1. Answer any **SIX**(THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Consider the pattern $P = a^3ba$. Construct the table and the corresponding labeled directed graph used in the "fast" pattern matching algorithm. 6

   b) Suppose A is a sorted array with 400 hundred elements, and suppose a given element x appears with the same probability in any place in A. Find the worst case running time $f(n)$ and the average case running time $g(n)$ to find x in A using the binary search algorithm. $5\frac{2}{3}$

2. a) Let n denote a positive integer. Suppose a function L is defined recursively as follows 5

   $$L(n) = \begin{cases} 0, & if\ n = 1 \\ L(\lfloor n/2 \rfloor + 1) & if\ n > 1 \end{cases}$$

   i). Find $L(25)$. ii) What does this function do?

   b) Consider the following stacks of city names: $6\frac{2}{3}$

   STACK: London, Berlin, Rome, Paris, _____, _____.

   i) Describe the stack as the following operations take place:

   A) PUSH(STACK, Athens)
   B) POP(STACK, ITEM)
   C) POP(STACK, ITEM)
   D) PUSH(STACK, Dhaka)
   E) PUSH(STACK, Tokyo)
   F) POP(STACK, ITEM)

   ii) Describe the stack if the operation POP(STACK, ITEM) deletes London.

3. a) What is transitive closure? Write a procedure that finals the shortest path from a given node NA to a given node NB. $4\frac{2}{3}$

   b) Discuss the standard ways of traversing a binary tree T with root R with examples. 4

   c) Describe merge short algorithm. 3

4. a) Construct a 3-way search tree for the list of keys in the order shown below. What are your observations? $5\frac{2}{3}$

   List A: 10, 15, 20, 25, 30, 35, 40, 45
   List B: 20, 35, 40, 10, 15, 25, 30, 45

   b) Consider the following 4-digit employee numbers 6

   9614, 5882, 6713, 4409, 7148

   Find the 2-digit hash address of each number using

   i) the division method with $m = 97$;
   ii) the midsquare method
   iii) the folding method without reversing; and
   iv) the folding method with reversing.

PART-B

5. a) What do you mean by feasible solution? Give the general method of Greedy algorithm. 5

b) Give an algorithm for Greedy Knapsack. Consider $n = 7,\ m = 20,$ $(p1, p2, p3, p4, p5, p6, p7) = (10, 5, 15, 7, 6, 18, 2)$ and $(w1, w2, w3, w4, w5, w6, w7) = (2, 3, 5, 7, 1, 4, 2)$. Obtain the optimal solution for this Knapsack instance. $6\frac{2}{3}$

6 a) Write algorithm for travelling salesperson problem using dynamic programming. $5\frac{2}{3}$

b) Schedule two jobs on 4 machine using flow shop scheduling technique. The time required by each operation of these jobs is given by following matrix. 6

$$J = \begin{bmatrix} 3 & 0 \\ 0 & 3 \\ 4 & 2 \\ 5 & 2 \end{bmatrix}$$

7 a) Differentiate between dynamic programming and divide and conquer paradigm. $3\frac{2}{3}$

b) Explain the concept of backtracking with the help of suitable example. 3

c) Solve 8-queen's problem for a feasible sequence (8, 2, 5, 3). 5

8 a) State the problem of graph coloring with example. $3\frac{2}{3}$

b) Prove that the size of the set of all subsets of n elements is 2^n. 4

c) Write down the general iterative backtracking method. On what factors does the mentioned backtracking algorithm depend? 4

Faculty of Engineering and Technology
B.Sc. Engineering 2nd Year 2nd Semester Examination-2017
Session: 2015-2016 & 2014-2015
Course Code: **ICE-2203** Course Title: **Analog Communication**

NB: 1. Answer any **SIX**(THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What do you mean by electronic communication? Define baseband and passband communication systems. 3
   b) Explain various types of noise those occur within electronic communication systems. 4
   c) Define modulation. Write the necessity of modulation. $4\frac{2}{3}$

2. a) Write the mathematical expression for phase modulated voltage with suitable graphical representation. 5
   b) How to find significant sidebands in case of frequency modulation using Bessel function of first kind? Also calculate significant sidebands for modulation index 0.0 to 1.5. 4
   c) A radio transmitter radiates 10 kW with carrier unmodulated and 11.25kW when the carrier is modulated by a sinusoidal voltage. Calculate the modulation index. Another sine wave is capable of producing 30% modulation. If both the sine waves simultaneously modulate the carrier, determine the total radiated power. $2\frac{2}{3}$

3. a) Classify radio transmitter according to the carrier frequency used. $3\frac{2}{3}$
   b) Explain Linear series plate modulation technique. 5
   c) What are the differences between FM and PM? 3

4. a) Draw the block diagram of a reactance modulator FM transmitter using AFC frequency stabilization and explain its operation. 6
   b) What is volume compressor? What improvement does it make when it is used in a radio broadcast transmitter? 4
   c) Define signal to distortion ratio. $1\frac{2}{3}$

PART-B

5. a) State some advantages of heterodyne receiver over TRF. 2
   b) Draw the block diagram of super-heterodyne AM receiver and discuss the function of each stage. $5\frac{2}{3}$
   c) What is meant by automatic volume control? Explain with useful circuit. 4

6. a) What do you mean by plasma and projection screen? 2
   b) Draw the block diagram of a TV receiver. 3
   c) Define Fine structure and Gross structure. Suppose your TV system uses 750 interlaced scan lines occurring at a rate of 25 frames per second. If about 85% to the complete horizontal scan is developed to display video and 15% to the horizontal blanking period, then calculate $6\frac{2}{3}$
   i) Active line per frame, and
   ii) Vertical resolution and horizontal resolution, assume the aspect ratio 4:3.

7. a) Sketch the sectional view of a picture tube that employs electrostatic focusing and electromagnetic deflection and also explain. $5\frac{2}{3}$
   b) What is vestigial sideband transmission and why is it used in TV broadcast system? 4
   c) Explain why a rectangular frame with aspect ratio of 4/3 is chosen in television transmission and reception. 2

8. a) Draw and explain the block diagram of a television receiver. 8
   b) What do you understand by compatibility in the TV transmission? $2\frac{2}{3}$
   c) Why synchronization pulse is necessary in TV transmission? 1

Department of Information and Communication Engineering

Pabna University of Science and Technology

Faculty of Science and Technology

B.Sc. Engineering 2nd Year 2nd Semester Examination-2017

Course Code: **ICE-2205** **Session:** 2015-16, 2014-15 Course Title:: **Signals and Systems**

N.B: 1. Answer any **SIX** (Three from each PART) questions.
2. Separate answer script must be used for answering the questions of PART-A and PART-B.
3. Figures in the right margin indicate marks.
4. Parts of the same question should be used for answered together and in the same sequence.

Time: 3 Hours (For Part A and Part B) **Total Marks: 70**

PART-A

1. a) Define following terms: i) Unit ramp, ii) Unit step and iii) Unit impulse. 3

b) What is the basic difference between discrete-time signal and digital signal? 2

c) Give that $X(n) = \{1, -2, \underset{\uparrow}{8}, 4, 5, -3, 7\}$ 3

Find i) $y(n) = \frac{1}{3}[x(n+1) + x(n-1)]$ ii) $y(n) = \frac{1}{2}[x(-n)]$.

d) Consider the analog signal: $x_a(t) = 3cos400\pi t + 10sin300\pi t - cos100\pi t$ $3\frac{2}{3}$

i) What is the Nyquest rate for this signal? ii) Suppose that the signal is sampled at the rate F_s =100 H_z .What is the discrete-time signal obtained after sampling?

2. a) Consider the system shown in Fig 2.b. Determine whether it is a) memoryless, b) causal, c) linear, d) time-invariant, and e) stable. 5

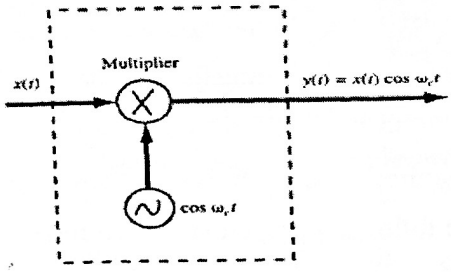


Fig-2.b

b) An LTI system has an impulse response $h(n) = u(n+1) - u(n-10)$. Determine the output of the system when the input, $x(n) = -u(n) + 2u(n-3) - u(n-6)$. $6\frac{2}{3}$

3. a) Determine if the systems described by the following input-output equations are linear or nonlinear. $y(n) = x^2(n)$. 3

b) What do you mean by time-invariant system and linear system? Explain with example. 5

Late

c) Express the given signal sequence as a time-shifted impulse. $X(n)$={ 1, -2, 8, 4, 5, -3, 7}.

4. a) What is the input signal x(n) that will generate the output sequence y(n)= { 1, 5, 10, 11,8, 4, 1} for a system with impulse response h(n)= { 1, 2, 1}. $6\frac{2}{3}$

b) Determine the cross-correlation sequence of the sequences x(n)= {1, 2, 3, 4,5} and y(n)= { 5,6, 7, 8, 9}. 5

PART-B

5. a) Derive the equations for exponential Fourier series. 3

b) Find the Fourier coefficients of the given signal 5

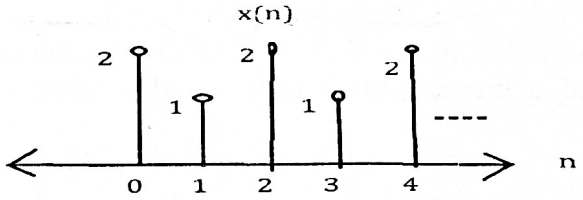
$$X(t) = 1 + sin2\omega_0 t + 2cos2\omega_0 t + cos\,(3\omega_0 t + \frac{\pi}{3}).$$

c) Drive the expression for power density spectrum of periodic signals. $3\frac{2}{3}$

6. a) Determine the Fourier transform of the signal $x(t) = e^{-at}sin\omega_0 t\,u(t)$. 3

b) Calculate the power density spectrum for given signal using Fourier series as complex form. 5

x(n) = [2 1 2 1 2 1 2 1 2 1----------]



c) Determine the Fourier transform of the signal $x(t) = e^{-at}u(t)$ where a > 0. Plot the magnitude and phase spectrum. $3\frac{2}{3}$

7. a) Derive synthesis and analysis equations of continuous time Fourier transform. $5\frac{2}{3}$

b) Prove the following properties for Discrete Fourier transform- 6

i)Time scaling , ii) Frequency shifting , and iii) Time reversal.

8. a) Distinguish between Fourier series analysis and Fourier transform. $3\frac{2}{3}$

b) Compute the IDFT of the four point sequence $X(\omega) = (4, 3 + j3, 2, 3 - j3)$. 4

b) Determine the 4-point DFT of the given signal 4

$$x(n) = \begin{cases} 1, & 0 \le n \le 3 \\ 0, & elsewher \end{cases}.$$

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Faculty of Engineering and Technology
B.Sc. Engineering 2nd Year 2nd Semester Examination-2017
Session: 2015-2016 & 2014-2015

Course Code: **ICE-2207** Course Title: **Electromagnetic Fields and Waves**

NB: 1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What is displacement current? And its significance? 2

   b) Find out the expression $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ and $\vec{\nabla}.\vec{B} = 0$ from the fundamental laws of physics. $5\frac{2}{3}$

   c) Show that Ampere's Law is inconsistent with the time varying equation of continuity. How did Maxwell overcome this inconsistency? 4

2. a) Derive the electromagnetic wave equation in a lossless medium. $5\frac{2}{3}$

   b) Given that $\vec{E} = i\overrightarrow{E_0}\,\mathrm{Sin}(\omega t - \beta z)$ in free space. Find the value for magnetic field intensity $\vec{H}$. Hence show that $\vec{E}$ and $\vec{H}$ are perpendicular to each other. 6

3. a) Define intrinsic impedance and propagation constant. 3

   b) State pointing vector. State and explain pointing theorem. $5\frac{2}{3}$

   c) A plane wave travelling in free space has an average pointing vector of 1 W/m^2. Find the average energy density. 3

4. a) How do the electrical properties of earth affect the surface wave propagation? $3\frac{2}{3}$

   b) Deduce the expression of refractive index of an ionized region, $\mu = \sqrt{1 - \frac{81N}{f^2}}$, where the symbols have their usual meanings. 6

   c) Define the terms used in radio wave propagation: i) Super refraction, and ii) Duct propagation. 2

PART-B

5. a) What do Fresnel's equations give? Deduce Fresnel's equations with suitable figures for incident wave polarized with E vector Normal to the Plane of Incidence. $7\frac{2}{3}$

   b) Define phase velocity and group velocity. Prove that the phase velocity and group velocity are equal for a freely propagating wave. 4

6. a) Derive the voltage and current equations for a transmission line. $6\frac{2}{3}$

   b) Explain various distributed parameters of transmission line. 3

   c) Discuss the line termination of a transmission line. 2

7. a) Define attenuation constant, phase constant, and propagation constant. 3

   b) Derive the equations for α and β in terms of primary constants. $5\frac{2}{3}$

   c) A transmission line has the following constants: 3
   R = 10.4 Ω, L = 3.666 mH, C = 0.00835 μF and G = 0.08 μ mhos. Calculate Z_0 at ω = 5000 radians/Sec.

8. a) What are waveguides and what are the boundary conditions for waveguides? 3

   b) Discuss TE and TM wave propagation between two parallel conductors. Obtain the expression i) group velocity, ii) phase velocity, and iii) cut-off frequency. $6\frac{2}{3}$

   c) Bring out the difference between E-wave and H-wave. 2

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Faculty of Engineering and Technology
B.Sc. Engineering 2nd Year 2nd Semester Examination-2017
Session: 2015-2016 & 2014-2015
Course Code: **Math-2201** Course Title: **Complex Analysis, Laplace and Fourier Transforms**

NB: 1. Answer any **SIX**(THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define modulus and argument of a complex number. Express the complex number $-3i$ into polar form. 4
   b) For any two complex numbers z_1 and z_2, prove that $|z_1 + z_2| \leq |z_1| + |z_2|$. $3\frac{2}{3}$
   c) Prove that $\lim_{z\to 0} \frac{\bar{z}}{z}$ does not exist. 4
2. a) Define analytic function. State and prove the necessary conditions of a function to be analytic. 4
   b) Prove that $f(z) = z^2$ is uniformly continuous in the region $|z| < 1$. 4
   c) Prove that the function $u = xe^x cosy - ye^x siny$ is harmonic. Find a function v such that $f(z) = u + iv$ is analytic. $3\frac{2}{3}$
3. a) State and prove the Cauchy's theorem. 5
   b) Prove that $\oint_c \frac{dz}{z-a} = 2\pi i$, where c is any simple closed curve and $z = a$ is inside of c. 3
   c) Evaluate $\int_c \frac{z^2-z+1}{z-1} dz$, where c is the circle $|z| = \frac{1}{2}$. $3\frac{2}{3}$
4. a) State Cauchy's integral formula. Evaluate $\oint_c \frac{e^{2z}}{(z+1)^4} dz$, where c is the circle $|z| = 3$. 6
   b) State Laurent's theorem. Expand $f(z) = \ln(1 + z)$, in a Tailor series about $z = 0$. $5\frac{2}{3}$

PART-B

5. a) Give the definition of Laplace transform. Find the Laplace transform of the function $F(t) = t\,sint$. 5
   b) If $\mathcal{L}\{f(t)\} = f(s)$ then prove that $\mathcal{L}\{e^{at} f(t)\} = f(s - a)$. 2
   c) Find the inverse Laplace transform of $\frac{s^3-2s^2+1}{s^2(s^2+1)}$. $4\frac{2}{3}$
6. a) Find the Laplace's transform of $\frac{d^3y}{dx^3}$. 5
   b) Solve the differential equation by using Laplace's transform: $\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = t^2;\ y(0) = 1,\ y'(0) = 3.$ $6\frac{2}{3}$
7. a) Define Periodic function, odd function & even function with example. 3
   b) Define Fourier series. Also determine the Fourier coefficients a_0, a_n and b_n for the function f(x) defined in the interval $(-\pi, \pi)$. 5
   c) Represent Fourier cosine series of the function $f(x) = x,\ 0 < x < 4$. $3\frac{2}{3}$
8. a) Define Fourier integral. Obtain the Fourier integral of an odd function. 5
   b) Use Fourier transform to solve $\frac{\partial u}{\partial t} = 3\frac{\partial^2 u}{\partial x^2};\ t > 0,\ 0 < x < 2,\ u(0,t) = u(2,t) = 0,\ u(x,0) = x$. $6\frac{2}{3}$

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2017
Session: **2015-2016 & 2014-2015**

Course Code: **STAT-2201** Course Title: **Sampling Distribution and Hypothesis Testing**

NB:
1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) State and define χ^2 distribution. Drive the characteristic function of χ^2 with n degree of freedom. 5
   b) Show that χ^2 distribution is a particular form of normal distribution for single degree of freedom. 1
   c) Show that the moment generating function of χ^2 distribution is $\frac{1}{(1-2t)^{\frac{n}{2}}}$, also find first four moments. $5\frac{2}{3}$

2. a) Show that, the value of Fisher's t is same as student's t. 3
   b) Find out the first four moments of F-distribution and hence comments about the shape characteristics of a distribution. 6
   c) What is students 't' distribution? Point out its usefulness. $2\frac{2}{3}$

3. a) Define statistical hypothesis. Distinguish between parametric and non-parametric hypothesis. 4
   b) Explain type I error and type II error with example. 3
   c) Define critical region. A single observation is made on the density $f\left(\frac{x}{\theta}\right) = \frac{1}{\theta}e^{-\frac{x}{\theta}}$, $x > 0$. If the critical region be defined by $x > 2$ for testing the H_0: $\theta = \theta_0 = 1$ against H_a: $\theta = \theta_a = 10$. Find α, β, and $\beta(\frac{w}{H_a})$. $4\frac{2}{3}$

4. a) What is the Best Critical Region (BCR)? State and explain Neyman-Pearson theorem. 6
   b) Suppose (x1, x2) be a random sample from the density $f\left(\frac{x}{\theta}\right) = \frac{1}{\theta}, 0 < x < \theta$ with H_0: $\theta = \theta_0 = 1$ and H_a: $\theta = \theta_a = 2$. Show that the power is determined by α and the distance between μ_0 and μ_a in one-tailed test under the above condition. $5\frac{2}{3}$

PART-B

5. a) Explain the following terms with the help of an example: 3
   i) Confidence limits, ii) Confidence Interval, and iii) Confidence Coefficients.
   b) The nine items of a sample had the following values: $4\frac{2}{3}$
   45, 47, 50, 52, 48, 47, 49, 53, 50
   The mean is 49 and the sum of squares of deviations taken from mean is 52.
   Can this sample be regarded as taken form the population having 47 as mean? Also obtain 95% and 99% confidence limits of the population mean.
   c) Explain briefly the properties of a good estimator. 4

6. a) Distinguish between probability density function and likelihood function. 2
   b) In random sampling from $N(\mu, \sigma^2)$, find the maximum likelihood estimator for: $3\frac{2}{3}$
      i) μ when σ^2 is known.
      ii) σ^2 when μ is known.
      iii) The simultaneous estimation of μ and σ^2.

c) List different methods of estimation. Explain the method of maximum likelihood estimation.

7. a) What is test of significance? Write some important tests of significance mainly used in statistics. 2

b) What are different applications of Normal test? Describe Normal test for single mean and difference of means. 6

c) The mean yields of two sets of plots and variability are given below. Test the hypothesis that the difference in the mean yields of the two sets of plots is significant. $3\frac{2}{3}$

	Sets of 40 plots	Sets of 60 plots
Mean yield/plot	1258	1243
S. D. per plot	34	28

8. a) What is χ^2-test? Describe χ^2-test for testing goodness of fit. 4

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

$$\chi^2 = \frac{n(ad-bc)^2}{(a+b)(c+d)(a+c)(b+d)} \text{ where } n = a+b+c+d.$$

c) In an experiment with immunization of goats from anthrax the following results were obtained. Derive your inference on the efficiency of the vaccine. $2\frac{2}{3}$

	Died	Survived
Inoculated	2	10
Not Inoculated	6	6

Department of Information and Communication Engineering
Pabna University of Science and Technology
B.Sc. Engineering 2nd Year 2nd Semester Final Examination – 2017
Course Code: Stat-2202
Course Title: Sampling Distribution and Hypothesis Testing Sessional

Time: 4 Hours **Marks: 60**

[Each problem carries same marks]

1. If Z~N (0, 1). For the following values of Z
-5.0, -4.9, -4.8, -4.7,....., 4.8,4.9,5.0.
   i. Create pdf of Z. Draw standard normal curve and comment the shape characteristics of the distribution.
   ii. Create pdf and cdf of X~N (last three digits of roll, 360000).
   iii. Find (a) P(X=700), (b) P(X>900), (c) P(1200<X<1800).
   iv. Construct normal density curve and normal cumulative distribution curve. Comment on your results.

2. If X follows binomial distribution with n=50 and p=0.4/0.7/0.3
   i. Sketch the graph for binomial probability distribution?
   ii. Compute (a) $P(X = 32)$, (b) $P(X \leq 21)$, (c) $P(X > 13)$, (d) $P(18 < X < 35)$
   iii. Find first four central moment of the distribution.
   iv. Find the skewness and kurtosis of the distribution.

3.

No. of printing mistakes	No. of pages	No. of printing mistakes	No. of pages	No. of printing mistakes	No. of pages
0	100	7	27	14	16
1	42	8	21	15	9
2	39	9	20	16	13
3	30	10	23	17	7
4	33	11	17	18	10
5	25	12	21	19 and above	4
6	29	13	14		

The following data gives the number of printing mistakes in a book of five hundred pages.
   i. Fit Poisson distribution to the above data.
   ii. Sketch the graph for Poisson distribution.
   iii. Compute (a) $P(X = 15)$, (b) $P(X < 10)$, (c) $P(X > 15)$, (d) $P(4 < X < 17)$
   iv. Find the skewness and kurtosis of the distribution.

4. Given the following data: 0,1,2,3,4,.....,98,99,100.
Show the relation between binomial distribution and Poisson distribution.

5. Draw random sample each of size 750 from ${x_3}^2$ and ${x_2}^2$ hence show that $\frac{{x_3}^2}{{x_2}^2}$ follows $\beta_2\left(\frac{3}{2}, \frac{2}{2}\right)$.

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019
Session: 2017-2018

Course Code: ICE-2201 **Course Title: Data Structure and Algorithm**

NB:
1. Answer any **SIX**(THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define data structure. Name different types of data structure. List operations that can be performed on these data structures. $3\frac{2}{3}$
   b) Using the bubble sort algorithm, find the number of comparisons (C) and the number of interchanges (D) which alphabetize the n = 7 letters in RAJAPUR. 3
   c) Write down the algorithm for binary search. Validate the algorithm with a suitable data set. 3
   d) Calculate the total number of moves for the Tower of Hanoi for n=15 disks. 2

2. a) Let a and b denote positive integers. Suppose a function Q is defined recursively as follows 5

$$Q(a,b) = \begin{cases} 0, & \text{if } a < b \\ Q(a-b,b)+1 & \text{if } b \le a \end{cases}$$

   i) Find the value of $Q(2,3)$ and $Q(14,3)$.
   ii) What does this function do? Find $Q(5861,7)$
   b) Define binary tree and complete binary tree with example. $6\frac{2}{3}$
   A binary tree T has 9 nodes. The inorder and preorder traversals of T yield the following sequences of nodes. Draw the tree T.
   Inorder: E A C K F H D B G
   Preorder: F A E K C D H G B

3. a) Define B tree. Construct a B tree of order 3 by inserting the following keys in the order shown into an empty B tree: M Q A N P W X T G E J 5
   b) Suppose the 7 data items are assigned the following weights: $6\frac{2}{3}$
   $(A,13), (B,2), (C,19), (D,23), (E,29), (F,5), (G,9)$.
   Find a 2-tree with a minimum weighted path length P. What is the Huffman coding for the 7 letters?

4. a) Write the insertion sort algorithm. Apply this insertion sort algorithm to sort the following numbers: 99, 77, 33, 44, 11, 88, 22, 66, 55 $5\frac{2}{3}$
   b) Consider the following 4-digit employee numbers 6
   9614, 5882, 6713, 4409, 7148
   Find the 2-digit hash address of each number using
   I) the division method with m=97;

PART-B

5. a) Define Laplace transformation. State and prove first shifting properties of Laplace transform. 3

b) Evaluate the Laplace transform problems: (i) $\ell\{t\}$, (ii) $\ell\{e^{at}\}$ and (iii) $\ell\{\sin at\}$. 4

c) If $\ell\{F(t)\} = f(s)$, then show that $\ell\{F(at)\} = f(s/a)/a$. Mention the name of this property. 3

d) Evaluate $\ell\{t^2 \cos at\}$. $1\frac{2}{3}$

6. a) Show that $\ell\{Y'(t)\} = sy(s) - Y(0)$, where $y(s)$ is Laplace transform of $Y(t)$. 2

b) Define inverse Laplace transform. Evaluate (i) $\ell^{-1}\{\frac{1}{s+1}\}$ and (ii) $\ell^{-1}\{\frac{s}{(s-b)^2+a^2}\}$. $3\frac{2}{3}$

c) Find the Laplace transform of the integral problem $\int_0^t \frac{\sin t}{t} dt$. 2

d) Solve the differential equation $y' + 2y = e^t$; $y(0) = 1$ by using Laplace transform. 4

7. a) Define periodic, odd and even function with examples. 3

b) Explain the Fourier series. Expand the function $f(x) = x/2$ in Fourier series over the interval $[0, 2\pi]$. Identify the series. 4

c) Expand the function $f(x) = x/2$ in Fourier series: $f(x) = \begin{matrix} \pi + x; & -\pi < x < 0 \\ \pi - x; & 0 < x < \pi \end{matrix}$ and deduce $4\frac{2}{3}$

$$\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots \quad \cdots$$

8. a) Develop $f(x) = \frac{1}{\pi}\int_0^\infty du \int_\infty^\infty f(t) \cos u(x-t) dt$ $3\frac{2}{3}$

b) Find the Fourier Transform of the function 4

$$F(x) = \begin{cases} 1 - x^2 & when\ |x| < 1\ or\ -1 < x < 1 \\ 0 & when\ |x| > 1\ or\ -1 > x > 1 \end{cases}$$

c) Using the Fourier Transform solve the problem: 4

$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$; $u(0,t) = 0$, $u(\pi,t) = 0$, $u(x,0) = 2x$ where $0 < x < \pi, t > 0$.

PART-B

5. a) What is a greedy algorithm? Write down its advantages and disadvantages.

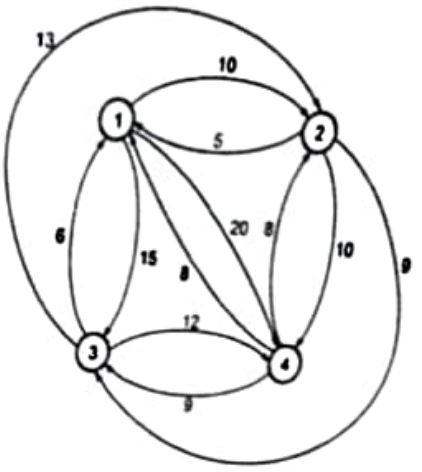
b) What is a recursive algorithm? Write an algorithm for tower of Hanoi puzzle to move n disk from tower x to tower y.

c) Define minimum-cost spanning tree. Illustrate with an example the Prim's algorithm to obtain a minimum-cost spanning tree.

6. a) Describes Bellman-Ford algorithm with example.

b) Explain Dijkstra's algorithm for finding the shortest path.

7. a) For the given diagraph, obtain optimum cost tour for the travelling salesperson problem.



b) Solve 0/1 Knapsack problem for the instance $n=4$, $m=21$, $(p1, p2, p3, p4) = (2, 5, 8, 1)$ and $(w1, w2, w3, w4,) = (10, 15, 6, 9)$.

8. a) State the principle of backtracking.

b) Give a formal definition of the n-queen's problem. Find all possible solution to 4-queen's problem. Establish the relationship between the two solutions.

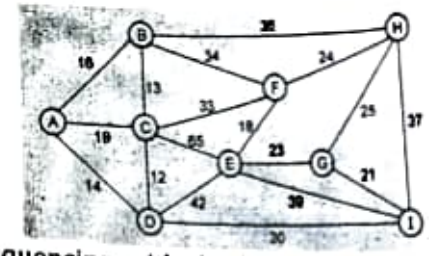
c) What do you understand by graph coloring? Describe backtracking algorithm to find all Hamiltonian cycles in a graph.

II) the midsquare method
III) the folding method without reversing; and
IV) the folding method with reversing.

PART-B

5. a) Define an algorithm. Explain the features of an efficient algorithm. 4
   b) Elaborate on asymptotic notations with examples. $3\frac{2}{3}$
   c) Calculate the time complexity of $1 + 3 + 5 + 7 + \cdots\cdots\cdots\cdots\cdots +999$. 4

6. a) State the general principle of the greedy algorithm. What is the drawback of the Greedy algorithm? $3\frac{2}{3}$
   b) Consider the following weighted graph. Give the list of edges in the MST in the order that Prim's algorithm inserts them. Start Prim's algorithm from vertex A. 4



   c) Explain how job sequencing with deadline problems can be solved using the Greedy approach. 4

7. a) Write the general procedure of dynamic programming. State the principle of optimality. $3\frac{2}{3}$
   b) Solve the all pairs shortest path problem for the digraph with the following weight matrix. 6

$$\begin{bmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{bmatrix}$$

   c) State the 0/1 knapsack problem.

8. a) What is backtracking? Write general recursive algorithm for backtracking. 2
   b) Differentiate between backtracking and branch and bound. Draw state space tree for the given sum of subset problem: $5\frac{2}{3}$
   Set of elements= {3, 5, 6, 7} and $d = 15$. 6

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2018
Session: 2016-2017

Course Code: ICE-2205 Course Title: Signals and Systems

NB:
1. Answer any SIX (Three from each PART) from following questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of PART-A and PART-B.

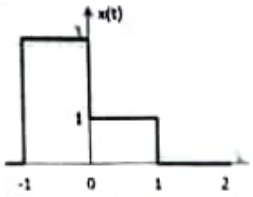
Time: 3 Hours Total Marks: 70

PART-A

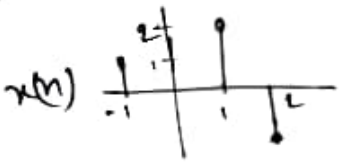
1. a) Define signal. Explain advantages of digital signal processing over analog signal processing. $2\frac{2}{3}$

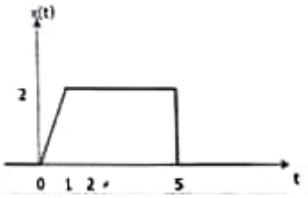
b) Explain the following terms: (i) Continuous-time and Discrete-time Signals and (ii) Deterministic and Random Signals. 3

c) Define even and odd signal. Develop the Even and Odd decomposition of x(t). 4



d) Express the following signal with unit step and ramp function. 2





2. a) Represent the following discrete signal using impulse signals, mathematically and graphically. 3
$x(n) = \{1, 2, 3, 4, -1\}$.
↑

b) Mention different types of operations on dependent variables of a continuous-time signal with example. 3

c) What is system? Draw the block diagram of the following moving average system $3\frac{2}{3}$
$y[n] = \frac{1}{5}(x[n] + x[n-1] + x[n-2] + x[n-3])$.

d) What is causal and invertible system? Explain these two systems with example. 2

3. a) Define Impulse Response. Explain following Properties of Systems: (i) Stability, (ii) Causality, and (iii) Linearity. 6

b) Write the steps of Graphical Estimation procedure of convolution integral. $2\frac{2}{3}$

c) Compare convolution sum and convolution integral. 3

4. a) Perform the convolution of the two sequences $x(n) = \{1, -2, 3, -2\}$; 5
$h(n) = \{2, -3, 4\}$.
↑ ↑

b) What do you mean by circular convolution? Using Circle method write the steps for computing circular convolution of two data sequences. 4

c) Find the circular convolution of two data sequences $x_1(n) = \{1, 2, -3, 4, -5\}$ and $x_2(n) = \{-2, 4, 6\}$ using matrix method. $2\frac{2}{3}$

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc (Engineering) 2nd Year 2nd Semester Examination-2018
Course Code: **ICE-2207** Course Title: **Electromagnetic Fields and Waves**

NB:
1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What are the physical significant of the Maxwell's equations? 2
   b) Derive the expression $\overline{\nabla}.\overline{D} = \rho$ and $\overline{\nabla} \times \overline{H} = \sigma\overline{E} + \epsilon\frac{\partial E}{\partial t}$ where the symbols have their usual meaning. $5\frac{2}{3}$
   c) What is scalar and vector potential? 4
2. a) Compute the intrinsic impedance of plane electromagnetic waves in free space. $6\frac{2}{3}$
   b) Derive the equation of Lorentz's Lemma. What does it mean? 3
   c) A plan sinusoidal electromagnetic wave travelling in free space has a maximum electric field intensity of 1500μV/m. Find the accompanying maximum magnetic field intensity. 4
3. a) Obtain poynting theorem for the conservation of energy in an electromagnetic field. $3\frac{2}{3}$
   b) Calculate the average of pointing vector of an EM wave in which the r.m.s value of E is 30 volt/m. $3\frac{2}{3}$
   c) Deduce the wave equation for $\vec{E}$ for a linear, isotropic and stationary medium (let, $\sigma = 0$ and $\rho = 0$). 4
4. a) Define the terms used in radio wave propagation: i) Virtual height, and ii) Maximum Usable Frequency. $3\frac{2}{3}$
   b) Prove that the skip distance D for a given frequency is given by
   $$D = 2h\sqrt{\left(\frac{f}{f_c}\right)^2 - 1}$$ 4
   c) Define Brewster angle and Critical angle. Prove that for glass-air interface (n_1=1.5 and n_2=1.0) for normal incidence the reflection and transmission coefficient are 0.04 and 0.96 respectively. $8\frac{2}{3}$

PART-B

5. a) Deduce Fresnel's equation at the boundary of two dielectrics for an electromagnetic wave polarized with its $\vec{E}$ vector parallel to the plane of incidence. 3
   b) Calculate the Brewster angles for the following cases; $5\frac{2}{3}$
   i) Light incident on a glass whose index of refraction is 1.6
   ii) Radio frequency wave incident on water (n=8).
6. a) Why is used waveguide? What are the possible modes for the TE waves in a rectangular waveguide? 3
   b) What are Guided waves? Derive the expressions for the field components of TE waves guided along circular waveguide. $5\frac{2}{3}$
   c) A high frequency transmission line consists of a pair of open wires having a distributed capacitance of 0.01μF/Km and a distributed inductance of 3mH/Km. Calculate the characteristic impedance and propagation constant at f=10MHz. 3
7. a) What do mean by lamped parameters and distributed parameters? Explain. 3
   b) Derive a condition for distortionless propagation on a transmission line. $6\frac{2}{3}$
   c) What is Standing Wave Ratio (SWR) and reflection coefficient? 2
8. a) Define smith chart. What are the purposes of impedance matching? 3
   b) What is rectangular waveguide? Show that for TE and TM wave in a rectangular waveguide in dimension a×b: $\frac{1}{\lambda_o^2} - \frac{1}{\lambda_g^2} = \frac{1}{4}\left(\frac{m^2}{a^2} + \frac{n^2}{b^2}\right)$, where m is the number of half cycles of $\vec{E}$ or $\vec{H}$ in the direction of X-axis and similarly for n. $6\frac{2}{3}$
   c) A 6 GHz signal is to be propagated in the dominant mode in a rectangular waveguide. If its group velocity is to be 90% of the free space velocity of light: What must be the breadth of the waveguide? 3

Data Structure and Algorithm

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019

Session: **2017-2018**

Course Code: **ICE-2205** Course Title: **Signals and Systems**

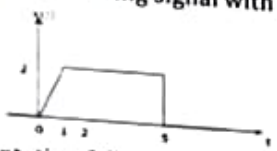
NB:
1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define signal. What are the major classifications of signal? 1.67
   b) Define energy and power of a signal. Find the energy and power of the signal, $x(t) = r(t) - r(t-2)$. 5
   c) What is digital signal processing? Write down the advantages of digital signal processing over analog signal processing. 5

2. a) Explain the operations performed on dependent variable of a signal. 6.67
   b) Define ramp function. Express the following signal with unit step and ramp function. 2



   c) Sketch the all possible representation following the output-input relationship $y[n] = \frac{1}{3}(x[n] + x[n-1] + x[n-2])$. 2
   d) Write the precedence rule for performing time-shifting and time scaling of a signal. 1

3. a) What do you understand by LTI system? 1.67
   b) Express the given signal sequences as a time-shifted impulse. 3

$$(i)\ x(n) = \{1,\ -2,\ 8,\ \underset{\uparrow}{4},\ 5,\ -3,\ 7\}$$

$$(ii)\ x(n) = \{2,\ 3,\ \underset{\uparrow}{0},\ 7,\ 8,\ -15,\ 18,\ 20\}$$

   c) An LTI system has impulse response $h(n)$.Determine the output for this system in response to$x(n)$ using direct approach, where 5

$$h(n) = \begin{cases} 1, & n = \pm 1 \\ 2, & n = 0 \\ 0, & \text{Otherwise} \end{cases} \quad \text{and} \quad x(n) = \begin{cases} 2, & n = 0 \\ 3, & n = 1 \\ -2, & n = 2 \\ 0, & \text{Otherwise} \end{cases}$$

   d) Write the Invertibility property of the system with an example. 2

4. a) Let $x(t) = 2u(t-1) - 2u(t-3)$ and $h(t) = u(t+1) - 2u(t-1) + u(t-3)$. Find the convolution integral of the sequences. 6
   b) What do you mean by circular convolution? Using the Circle method write the steps for computing circular convolution of two data sequences. 3
   c) Find the circular convolution of two data sequences $x_1(n) = \{1, 2, -3, 4, -5\}$; $x_2(n) = \{-2, 4, 6\}$ using matrix method. 2.67

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2018
Session:2016-2017

Course Code: ~~ICE~~ STAT-2201 Course Title: **Sampling Distribution and Hypothesis Testing**

NB: 1. Answer any SIX (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What do you mean by census survey and sample survey? Define the term 'sampling' and mention some important techniques of sampling. $2\frac{2}{3}$
   b) State and define χ^2 distribution. Write different characteristics and applications of χ^2 distribution. 5
   c) State and proof the additive property of χ^2 variate. 2
   d) What is random sampling and degree of freedom (d. f)? 2

2. a) Define the terms: Estimation, Estimator and Estimate. Show that all estimators are statistics but all statistics are not estimator. 4
   b) What is maximum likelihood estimator? Find the maximum likelihood estimate for the parameter λ of a Poisson distribution on the basis of a sample size n. $5\frac{2}{3}$
   c) What do you mean by efficiency and most efficient estimator? 2

3. a) Define Student's t distribution and derive it from sampling distribution. 6
   b) Find skewness and kurtosis of t-distribution and make comment about the shape of distribution. $5\frac{2}{3}$

4. a) What is sufficiency? Prove that a necessary and sufficient condition for t to be sufficient for θ is that the likelihood function L may be factorized as follows: $L = g(t/\theta)\ K(x_1, x_2, \cdots \cdots, x_n)$. 6
   b) State and define binomial distribution. Write some underlying conditions of binomial distribution. 2
   c) An unbiased coin is tossed 6 times. Find the probability of getting $3\frac{2}{3}$
      i. Exactly 3 flowers.
      ii. At least 5 flowers.
      iii. At best 3 flowers.

PART-B

5. a) What do you mean by null hypothesis, alternative hypothesis and level of significance (α)? 3
   b) Explain critical region and acceptance region. 2
   c) State and define randomized Neyman-Pearson theorem. 2
   d) Suppose the random sample($x_1, x_2, \ldots\ldots\ldots, x_n$) have the likelihood function $L\left(\frac{x}{\theta}\right)$. If we wish to test H_0: $\theta = \theta_0$ against Ha: $\theta = \theta_a \neq \theta_0$ where θ_a is an element of A. Then show that there is no UMP critical region with the following regularity conditions. $4\frac{2}{3}$

   Regularity conditions:
   i. $L(x/\theta)$ is continuous for $x \in w$ and $\theta \in r$.
   ii. $\frac{\partial L(x/\theta)}{\partial \theta}$ exists and continuous.
   iii. $\frac{\partial L(x/\theta)}{\partial \theta}$ is never identically equal to 0 in x for any θ.
   iv. $\frac{\partial}{\partial \theta}\int_w L(x/\theta)dx = \int_w \frac{\partial}{\partial \theta} L(x/\theta)d\theta$.

Department of Information and Communication Engineering

Pabna University of Science and Technology

Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019

Session: 2017-2018

Course Code: **STAT-2201** Course Title: **Sampling Distribution and Hypothesis Testing**

NB: 1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate full marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the questions of **PART-A** and **PART-B**.

Total Marks: 70

Time: 3 Hours

PART-A

1. a) Define sampling distribution. Show that chi-square (χ^2)distribution is a sampling distribution of normal distribution. 4
   b) Show that variance of χ^2 distribution is twice of the mean of χ^2 distribution. 4
   c) Write down the properties of student't distribution. 3.67

2. a) Define F- distribution. If we draw two independent samples of size n_1 and n_2 respectively from two normal populations with the same variance than $\frac{S_1^2}{S_2^2} \sim F(n_1 - 1, n_2 - 1)$. 5.67
   b) Establish the interrelationship between t, χ^2 and F statistic. 6

3. a) What do you understand by Point Estimation? When would you say that estimate of a parameter is good? 3.67
   b) Discuss the terms i) estimate, ii) consistent estimate, iii) unbiased estimate, of a parameter, and show that sample mean is both consistent and unbiased estimate of the population mean. 5
   c) Sample variance is consistent but biased estimator for population variance, justify. 3

4. a) Define maximum likelihood function with an example. 2
   b) What are the methods of finding an estimator? Describe any one method. 5
   c) If $X_1, X_2, \ldots\ldots X_n$ be a random sample of 'n' observation from the Poisson population with parameter θ. Find the MLE of θ. 4.67

PART-B

5. a) Define test of Hypothesis, one-tailed test, two-tailed test, and level of significance. 4
   b) Describe the test procedure of equality of two means. 3
   c) The numbers of computer scientists coming out from two different universities A and B are employed in different organizations to do the job related to computers 4.67

University	Number of graduates employed
A	17, 15, 13, 20, 22, 25
B	10, 18, 33, 15, 12, 18, 27

Do you think that the employment facility for both the universities is similar? 2

6. a) What do you mean by best critical region and most powerful test? 3.67
   b) State the Neyman-Pearson theorem. Discuss the role of this theorem in hypothesis testing 6
   c) Suppose the observations 15, 28, 3, 12, 19, 20, 2, 25, 30, 62, 12, 18, 16, 27, 33, 36, 41, 9, 21, 12, 26, 4, 65 have come from an exponential distribution with mean θ. Perform an MP test of size $\alpha = 0.05$ for testing $H_0: \theta = 20$ vs $H_1: \theta = 23$.

Pabna University of Science and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2019

Session: **2017-2018**

Course Code: **Math-2201** Course Title: **Complex Analysis, Laplace, Fourier Transform**

NB: 1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the questions of **PART-A** and **PART-B.**

Total Marks: 70

Time: 3 Hours

PART-A

1. a) Define complex number, absolute of complex number and modulus of complex number with examples. 3

   b) For complex number prove that $|z_1 z_2| = |z_1||z_2|$. Given a complex number (vector) z, explain geometrically $ze^{i\alpha}$, where α is real. 4

   c) Define analytic function at a point. Explain various types of singularities with examples. $4\frac{2}{3}$

2. a) Define harmonic function. Prove that the function $u = 2x(1-y)$ is harmonic, find the complex conjugate v of the u such that $f(z) = u + iv$ is analytic and also evaluate $f(z)$ in terms of z. 4

   b) If $f(z) = u(x,y) + iv(x,y)$ is analytic in a region R, prove that u and v are harmonic in R if they have continuous second partial derivatives in R. 4

   c) Define complex line integral, simply connected region, multiply connected region. Establish the connection between real and complex line integrals. $3\frac{2}{3}$

3. a) State and prove Cauchy integral formulae. 4

   b) Evaluate $\oint_C \frac{e^z}{(z^2+\pi^2)^2} dz$, where C is the circle $|z| = 4$. 3

   c) State Morera's theorem. Evaluate $\oint_C \frac{dz}{z-1}$ around (i) the circle $|z-2| = 4$, (ii) the circle and (iii) the square with vertices at $1 \pm i, -1 \pm i$. $4\frac{2}{3}$

4. a) Applying calculus of residues prove that
$$\int_{\infty}^{\infty} \frac{dx}{(1+x^2)^2} = \frac{\pi}{4}$$ $6\frac{2}{3}$

   b) Define conformal bilinear mappings. Show that $w = \frac{1}{z}$ maps the exterior of the unit circle in z-plane and inside the unit circle of w-plane (sketch the map only). 5

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2018
Session: 2016-2017

Course Code: **Math-2201** Course Title: **Complex Variable Analysis, Laplace and Fourier Transforms**

NB:
1. Answer any **SIX (Three from each PART)** from following questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define polar form of a complex number. Express the complex number $-\sqrt{6}-\sqrt{2}i$ into polar form. 4

   b) Given a complex number (vector) z, interprete geometrically $ze^{i\alpha}$, where α is real. $3\frac{2}{3}$

   c) For any two complex number z_1 and z_2, prove that $|z_1+z_2| \le |z_1|+|z_2|$. 4

2. a) Define analytic function. State and prove necessary condition for a function to be analytic. 6

   b) What do you mean by harmonic function? Prove that $u = 2x(1-y)$ is a harmonic function and find its harmonic conjugate v. $5\frac{2}{3}$

3. a) Use Cauchy's theorem to evaluate $\oint_c \frac{z+4}{z^2+2z+5}dz$, where $c\ |z+1|=1$.

   b) State and prove the Cauchy's integral formula. $5\frac{2}{3}$

   c) Evaluate $\oint_c \frac{\sin \pi z^2+\cos \pi z^2}{(z-1)(z-2)}dz$, where c is the circle $|z|=3$. $3\frac{1}{3}$

4. a) State Taylor's theorem. Find the Lautent's series about the indicated singularity for the function, $\frac{1}{z^2(z-3)^2}$; $z=3$. Also name the singularity. $5\frac{2}{3}$

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

PART-B

5. a) If λ_1 and λ_2 are any constants while $F_1(t)$ and $F_2(t)$ are functions with Laplace transform $f_1(s)$ and $f_2(s)$ respectively then show that $\mathcal{L}\{\lambda_1F_1(t)+\lambda_2F_2(t)\} = \lambda_1\mathcal{L}\{F_1(t)\}+\lambda_2\mathcal{L}\{F_2(t)\}$. 5

   b) Find the Laplace transform of $e^{3t}(2\cos 5t - 3\sin 5t)$ $3\frac{2}{3}$

   c) Define Inverse Laplace's transform. Evaluate $\mathcal{L}^{-1}\left\{\frac{6s-4}{s^2-4s+20}\right\}$. 5

6. a) If $\mathcal{L}\{F(t)\}=f(s)$, then show that $\mathcal{L}\{F'''(t)\} = s^3f(s)-s^2F(0)-sF'(0)-F''(0)$. $6\frac{2}{3}$

   b) Solve the differential equation by using Laplace's transform:
   $\frac{d^2y}{dt^2}+y=t^2;\quad y(0)=1, y'(0)=-2$. 1

7. a) What do you mean by Fourier series? 5

   b) Determine the Fourier sine series in the interval $(0,\pi)$. $5\frac{2}{3}$

   c) Determine the Fourier cosine series over period 4, when $f(x)=x, 0<x<4$ and hence show that $\frac{\pi^2}{8}=1+\frac{1}{3^2}+\frac{1}{5^2}+\cdots\cdots\cdots\cdots$ 5

8. a) Obtain the Fourier integral $(x)=\frac{1}{2\pi}\int_{-\infty}^{\infty}f(t)dt\int_{-\infty}^{\infty}\cos\{u(x-t)\}du$. $6\frac{2}{3}$

   b) Use Fourier transform to solve $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}; t>0, 0<x<\pi, t>0$
   $u(0,t)=u(\pi,t)=0, u(x,0)=2x$.

6. a) Define parametric and non-parametric test with example. Write advantages and disadvantages of non-parametric test.

b) State and explain Sign test mentioning all possible assumptions, hypotheses and test statistic. 4

c) The appearance transit times for 11 patients with significantly dengue virus are as follows: $3\frac{2}{3}$

Patients' No	:	1	2	3	4	5	6	7	8	9	10	11
Transit time (Sec)	:	1.80	3.30	5.65	2.25	2.50	3.50	2.75	3.25	3.10	2.70	3.00

Can you calculate that at 5% level of significance, the median appearance transit time in the population from which the sample was drawn is 3.50 seconds?

7. a) What is parameter and parametric hypotheses? 2

b) What is test of hypotheses? Define one tailed and two tailed test? 2

c) Describe the test of equality of two means. 4

d) The number of ICE graduates coming from two universities A and B are employed in different organizations to do job in the relevant field. The numbers are given for different years as follows: $3\frac{2}{3}$

University	Number of graduates employed in the relevant job
A	18, 16, 15, 20, 18, 15, 12
B	20, 14, 12, 22, 16, 14, 15, 10, 12, 18, 10

Do you think that the employment facility for both the universities is similar?

8. a) Describe the test procedure of Run test and Rank Sum test. $6\frac{2}{3}$

b) A sample of 200 patients was collected that they were suffering from a particular disease. A particular drug was given to 100 patients and no drug was given to rest of 100 patients. The results are given as following: 5

Particular	Number of Patients		
	Taken drug	No Drug	Total
Cure	65	55	120
Not cure	35	45	80
Total	100	100	200

Drive your inference on the efficiency of the drug at $\alpha = 0.005$.

$\bar{x}_1 = \frac{114}{7} = 16.2852$

$S_1 = \frac{1}{N-1}\left(\sum_{i=1}^{n}(x_i^2 - N\bar{x}^2)\right)$

$= \frac{1}{6}(1898 - 1856.41$

6.95

$\bar{x}_2 = \frac{163}{11}$

$= 14.818$

$S^2 = \frac{1}{10}(256) - 2415.90$

$= 15.369$

$t = \frac{S_1(n_1 - 1) + S_2(n_2 - 1)}{n_1 + n_2 + 2}$

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology

B.Sc (Engineering) 2nd Year 2nd Semester Examination-2018

Course Code: **ICE-2203** Course Title: **Analog Communication**

NB: 1. Answer any **SIX** (THREE from each PART) questions
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) With a suitable block diagram describe the key components of a communication system. 4
   b) Why modulation is necessary in communication? 3
   c) Describe some sources of noise that impair communication. $4\frac{2}{3}$

2. a) Draw and describe the block diagram of a PLL. 4
   b) What is capture range? Differentiate between broadcasting, point to point communication and multicasting communication system. 3
   c) What is Amplitude modulation? Draw a comparison between AM and FM. $4\frac{2}{3}$

3. a) Explain pre-emphasis and de-emphasis with necessary circuit diagram. 4
   b) Define noise and SNR. How the SNR can be used to improve radio signaling? 3
   c) Draw and explain the block diagram of an AM Transmitter. $4\frac{2}{3}$

4. a) Draw and explain the block diagram of an FM receiver. 5
   b) Write down the advantages and disadvantages of pulse modulation 3
   c) Mathematically explain DSBFC. $3\frac{2}{3}$

PART-B

5. a) Write down the basic functions of an AM receiver, at the same time mention silent feature of radio receiver. 4
   b) Draw and briefly explain the block diagram of a super heterodyne AM radio receiver. $5\frac{2}{3}$
   c) Why is double super heterodyne receiver used? 2

6. a) What is AFC? Mention the spurious responses in radio receivers. $4\frac{2}{3}$
   b) Discuss the communication, code and radar receivers. 7

7. a) What are the basic factors must be considered in TV system for successful transmission and reception of picture? How is the illusion of continuity created in television pictures? 4
   b) Justify the choice 625 lines of TV transmission. $3\frac{2}{3}$
   c) Discuss briefly monochrome picture tube with figure. 4

8. a) What do you understand by blanking pulse and synchronization pulse? 3
   b) Draw and level composite video signal. $3\frac{2}{3}$
   c) What is vestigial sideband transmission and why is it used in TV broadcast system? 3
   d) What do you mean by compatibility in TV transmission? 2

Department of Information and Communication Engineering

Pabna University of Science and Technology

Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019

Session: 2017-2018

Course Code: **ICE-2207** Course Title: **Electromagnetic Fields and waves**

NB:
1. Answer any **SIX**(THREE from each PART) questions.
2. Figures in the right margin indicate full marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the questions of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What is displacement current? And its significance? 2
   b) Find out the expressions: i) $\vec{\nabla} \times \vec{E} = \frac{\partial \vec{B}}{\partial t}$, and ii) $\vec{\nabla}.\vec{B} = 0$, from the fundamental laws of physics. $5\frac{2}{3}$
   c) State and explain pointing theorem. 4

2. a) Define scalar potential and vector potential. 2
   b) Prove that uniform plane electromagnetic waves are transverse in nature $6\frac{2}{3}$
   c) Explain the physical significance of Maxwell's field equations. 3

3. a) What do you mean by depth of penetration? 2
   b) Derive the equation of propagation of the plane electromagnetic wave in the perfect dielectric medium. $6\frac{2}{3}$
   c) Deduce the equation of Lorentz's Lemma. 3

4. a) Define ground wave and sky wave. 2
   b) Show that $\mu = \sqrt{1 - \frac{81N}{f^2}}$, where the symbols have their usual meanings. $6\frac{2}{3}$
   c) At what frequency, a wave must be propagated for the D region to have an index of refraction 0.5? Given N=400 electron/cc for D region. 3

PART-B

5. a) Define Brewster angle and Critical angle. 2
   b) Explain the total internal reflection of Electromagnetic waves. 3
   c) Deduce Fresnel's equation at the boundary of two dielectrics for an electromagnetic wave polarized with its $\vec{E}$ vector normal to the plane of incidence. $6\frac{2}{3}$

6. a) Bring out the difference between E-wave and H-wave. 3
   b) Deduce the equation of characteristics impedance of an infinite transmission line. $5\frac{2}{3}$
   c) A high-frequency transmission line consists of a pair of open wires having a distributed capacitance of 0.01μF/Km and a distributed inductance of 3mH/Km. What are the characteristics of impedance and propagation constant at f = 10MHz? 3

7. a) What are the types of line distortions? Show that when the series resistance R and the shunt capacitance C of a transmission line are small but not negligible, the attenuation constant may be written as $6\frac{2}{3}$

$$\alpha = \frac{R}{2}\sqrt{\left(\frac{C}{L}\right)} + \frac{G}{2}\sqrt{\left(\frac{L}{C}\right)}.$$

   b) Define propagation constant. What are the values of SWR for open circuits, short circuits, and matched load? 3
   c) What is the input impedance of an open-circuited lossless transmission line if the length of the line is (i) $\lambda/4$ (ii) $\lambda/2$ and (iii) $3\lambda/4$ 2

8. a) What do you mean by circular waveguide?
   b) Explain $TE_{m,n}$ and $TM_{m,n}$ for a rectangular waveguide
   c) Why TEM waves cannot propagate through a rectangular waveguide?

7. a) What do you mean by the test of independence? Describe the test of independency procedure of 2 ×2 contingency table. 4.67

b) A survey on the professor of 125 persons was conducted to see whether their occupation was associated with their fathers's occupation. The following results were obtained 7

	Son's occupation			
		Agriculture	Business	Service
Father's occupation	Agriculture	25	5	15
	Business	10	19	16
	Service	4	3	28

Test the hypothesis that son's occupation is independent of father's occupation.

8. a) Distinguish between parametric and non-parametric tests. 3

b) Describe the Wilcoxon singed-rank test for dependent populations. 4

c) Eight observations were randomly selected from two populations that were not normally distributed. Use the 0.05 significance level, the Wilcoxon rank-sum test to determine whether there is a difference between two populations 4.67

Population A: 38, 45,56,57,61,69,70,79

Population B: 26,31,35,42,51,52,57,62

Department of Information and Communication Engineering
Pabna University of Science and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019
Session: 2017-2018

Course Code: **ICE-2203** Course Title: **Analog Communication**

NB:
1. Answer any **SIX (THREE** questions from each **PART)** questions.
2. Figures in the right margin indicate full marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define modulation and demodulation. 2.67
   b) Draw the block diagram of a typical A.M. superheterodyne receiver and explain the function of each stage. 5
   c) A radio transmitter radiates 10kW with the carrier unmodulated and 11.25kW when the carrier is modulated by a sinusoidal voltage. Calculate the modulation index. Another sine wave is capable of producing 30% modulation. If both the sine waves simultaneously modulate the carrier, determine the total radiated power. 4

2. a) Name the typical sources of man-made noise or industrial noise. Deduce necessary expression for finding Noise Temperature of a receiver. 5.67
   b) Prove that after amplitude modulation, the carrier power increases from P_c to $P_c\left(1+\frac{m_a^2}{2}\right)$ where, m_a is the modulation index. 3
   c) What is meant by the term Frequency Deviation? Draw the waveform generated by frequency modulation. 3

3. a) Draw and explain the block diagram of an FM Transmitter. 4
   b) Draw pre-emphasis and de-emphasis circuit. Why is it necessary to employ pre-emphasis and de-emphasis in FM system? 5
   c) Differentiate the terms noise and distortion. 2.67

4. a) Classify radio transmitter according to carrier frequency used. 4
   b) Explain with diagram the operation of SSB transmission system. 3.67
   c) Briefly explain master oscillator. 4

PART-B

5. a) Compare between AM and FM receiver. 4
   b) Draw and briefly explain the block diagram of a FM broadcast receiver. 4
   c) What is cross modulation? Calculate cross modulation. 3.67

6. a) Mention the spurious responses in radio receiver. 3
   b) What is meant by AGC? Provide your explanation with appropriate circuit diagram. 4
   c) Explain the working principle of picture transmission in television system with suitable block diagram. 4.67

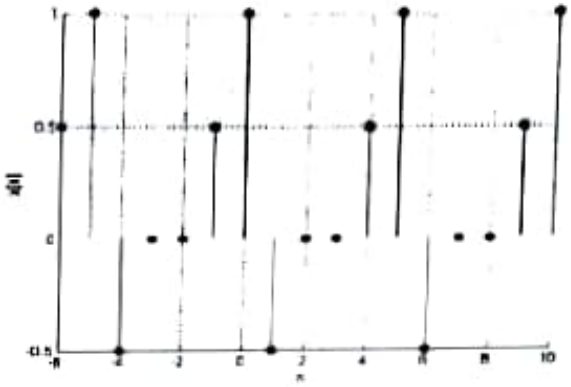
7. a) What is scanning and interlace scanning? 3.67
   b) How do you calculate the number of scanning line? 2
   c) What is composite video signal? 2
   d) Explain the vestigial sideband transmission with diagram. 4

8. a) Explain briefly, how the electron beam is focused on the tube screen. What is meant by crossover point in the electron gun? 4
   b) How is the illusion of continuity created in television pictures? 3
   c) Draw and describe the block diagram of television receiver section in details. 4.67

PART-B

5. a) Why do we need Fourier Representation of signals? 2

   b) Find the DTFS of the following signal. $5\frac{2}{3}$



   c) Prove that DFT is periodic with period N. 4

6. a) With suitable figure derive necessary equations of DTFT. $5\frac{2}{3}$

   b) Find the DTFT of (i) $x(n) = \alpha^n u[n]$, *where* $\alpha = 0.5$ and (ii) $x(n) = 2(3)^n u(-n)$ 6

7. a) Explain the periodicity and linearity properties of DFT. 4

   b) A discrete time signal x(n) = {1,0,1,2,3,2} find the total energy E_t of the signal. 3

   c) Find the DFT for the following finite length sequence, x(n) = $\{\frac{1}{4}, \frac{1}{4}, \frac{1}{4}\}$. $4\frac{2}{3}$

8. a) Explain Matrix Representation of the DFT. $5\frac{2}{3}$

   b) What is FFT? Why it is needed? 2

   c) Write the DIT Algorithm for N = 4. Also draw the Signal Flow Graph. 4

PART-B

5.	a)	Explain DTFS. Deduce its pair expression.	3	
	b)	Find the DTFS of the signal $x(n) = \{\underset{\uparrow}{0.5}, 1, -4, 0, 0\}$.	3	
	c)	Deduce the expression for DTFT.		5.67
6.	a)	Explain how aperiodic signals can be represented by Fourier ~~series~~ Transform	4	
	b)	Find the DTFT of the sequences i)$x(n) = \alpha^n u(n)$, *where* $\alpha = 0.5$, and (ii) $x(n) = 2(3)^n u(-n)$.	4	
	c)	What is meant by sampling? State sampling theorem.		3.67
7.	a)	Find the convolution of the sequences $h(n) = \left(\frac{1}{2}\right)^n u(n)$ and $x(n) = \left(\frac{1}{3}\right)^n u(n)$, using convolution property of DTFT.		3.67
	b)	Write the process of performing Fourier transform of an analog signal $x(t)$ by using digital computers.	4	
	c)	Deduce the DIT algorithm for a 4-point sequence, i.e., $N = 4$.		4
8.	a)	Explain DFT and Its Inverse	2	
	b)	Describe matrix representation of DFT.		4.67
	c)	Find 4-point DFT and IDFT for the given data sequence $x(n) = \{1, 2, 1, 1\}$.		5

Department of Information and Communication Engineering
Pabna University of Science and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2018
Session: **2016-2017**

Course Code: **ICE-2201** Course Title: **Data Structure and Algorithm**

NB:
1. Answer any **SIX** (three from each part) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the questions of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What are the differences between a Stack, Queue and Array? 4
   b) Mention the advantage of sparse matrix. Suppose an integer occupies 4 bytes of memory space. Then Calculate the memory space required to store a 2D-array **int LA[30][50]**. If the starting address (base address) of **LA** is 2000H, then calculate the address of **LA[11][15]**. $3\frac{2}{3}$
   c) Explain the process of insertion an item into a linked list in the middle. 4

2. a) Write down the properties of stack and queue data structures. Write an algorithm to insert an item into a stack. 4
   b) Let a and b denote positive integers. Suppose a function Q is defined recursively as follows: 4

$$Q(a,b) = \begin{cases} 0, & if\ a < b \\ Q(a-b,b)+1, & if\ a \geq b \end{cases}$$

   (i) Find the value of $Q(2,3)$ and $Q(14,3)$
   (ii) What does this function do? Find $Q(5861,7)$
   c) What are the most commonly used operations on a link list? Is it possible to apply binary search algorithm in a sorted linked list? Write a program segment to insert an item of a node in a linked list at any position. $3\frac{2}{3}$

3. a) Given that following list of 12 numerical data : 5
   44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66.
   Use the quicksort algorithm to find the final position of the first number 44.
   b) Write an ADT to implement stack of size N using an array. The elements in the stack are to be integers. The operations to be supported are PUSH, POP and DISPLAY. Take into account the exceptions of stack overflow and stack underflow. $6\frac{2}{3}$

4. a) Define "extended binary tree". Explain with an example, how to convert a binary tree to an extended binary tree. $3\frac{2}{3}$
   b) Construct a 3-way search tree for the list of keys in the order shown below. What are your observations? 4
   List A: 10, 15, 20, 25, 30, 35, 40, 45
   List B: 20, 35, 40, 10, 15, 25, 30, 45
   c) Apply selection sort algorithm to sort the following elements: 4
   77, 33, 44, 11, 88, 22, 66, 55, 99

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019
Session: 2017-2018

Course Code: **ICE-2201** Course Title: **Data Structure and Algorithm**

NB:
1. Answer any **SIX**(THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define data structure. Name different types of data structure. List operations that can be performed on these data structures. $3\frac{2}{3}$
   b) Using the bubble sort algorithm, find the number of comparisons (C) and the number of interchanges (D) which alphabetize the n = 7 letters in RAJAPUR. 3
   c) Write down the algorithm for binary search. Validate the algorithm with a suitable data set. 3
   d) Calculate the total number of moves for the Tower of Hanoi for n=15 disks. 2

2. a) Let a and b denote positive integers. Suppose a function Q is defined recursively as follows 5

$$Q(a,b) = \begin{cases} 0, & if\ a < b \\ Q(a-b,b)+1 & if\ b \le a \end{cases}$$

   i) Find the value of $Q(2,3)$and $Q(14,3)$.
   ii) What does this function do? Find $Q(5861,7)$
   b) Define binary tree and complete binary tree with example. $6\frac{2}{3}$
   A binary tree T has 9 nodes. The inorder and preorder traversals of T yield the following sequences of nodes. Draw the tree T.
   Inorder: E A C K F H D B G
   Preorder: F A E K C D H G B

3. a) Define B tree. Construct a B tree of order 3 by inserting the following keys in the order shown into an empty B tree: M Q A N P W X T G E J 5
   b) Suppose the 7 data items are assigned the following weights: $6\frac{2}{3}$
   $(A,13),(B,2),(C,19),(D,23),(E,29),(F,5),(G,9)$.
   Find a 2-tree with a minimum weighted path length P. What is the Huffman coding for the 7 letters?

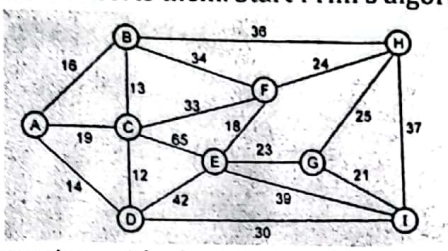
4. a) Write the insertion sort algorithm. Apply this insertion sort algorithm to sort the following numbers: 99, 77, 33, 44, 11, 88, 22, 66, 55 $5\frac{2}{3}$
   b) Consider the following 4-digit employee numbers 6
   9614, 5882, 6713, 4409, 7148
   Find the 2-digit hash address of each number using
      I) the division method with m=97;

II) the midsquare method
III) the folding method without reversing; and
IV) the folding method with reversing.

PART-B

5. a) Define an algorithm. Explain the features of an efficient algorithm. 4
   b) Elaborate on asymptotic notations with examples. $3\frac{2}{3}$
   c) Calculate the time complexity of $1 + 3 + 5 + 7 + \cdots \ldots \ldots \ldots \ldots \ldots + 999$. 4

6. a) State the general principle of the greedy algorithm. What is the drawback of the Greedy algorithm? $3\frac{2}{3}$
   b) Consider the following weighted graph. Give the list of edges in the MST in the order that Prim's algorithm inserts them. Start Prim's algorithm from vertex A. 4



   c) Explain how job sequencing with deadline problems can be solved using the Greedy approach. 4

7. a) Write the general procedure of dynamic programming. State the principle of optimality. $3\frac{2}{3}$
   b) Solve the all pairs shortest path problem for the digraph with the following weight matrix. 6

$$\begin{bmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{bmatrix}$$

   c) State the 0/1 knapsack problem. 2

8. a) What is backtracking? Write general recursive algorithm for backtracking. $5\frac{2}{3}$
   b) Differentiate between backtracking and branch and bound. Draw state space tree for the given sum of subset problem: 6
   Set of elements= $\{3, 5, 6, 7\}$ and $d = 15$.

Department of Information and Communication Engineering
Pabna University of Science and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019
Session: 2017-2018
Course Code: ICE-2203 Course Title: Analog Communication

NB:
1. Answer any SIX (THREE questions from each PART) questions.
2. Figures in the right margin indicate full marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of PART-A and PART-B

Time: 3 Hours **Total Marks: 70**

PART-A

1.	a)	Define modulation and demodulation.	2.67
	b)	Draw the block diagram of a typical A.M. superheterodyne receiver and explain the function of each stage.	5
	c)	A radio transmitter radiates 10kW with the carrier unmodulated and 11.25kW when the carrier is modulated by a sinusoidal voltage. Calculate the modulation index. Another sine wave is capable of producing 30% modulation. If both the sine waves simultaneously modulate the carrier, determine the total radiated power.	4
2.	a)	Name the typical sources of man-made noise or industrial noise. Deduce necessary expression for finding Noise Temperature of a receiver.	5.67
	b)	Prove that after amplitude modulation, the carrier power increases from P_c to $P_c\left(1+\frac{m_a^2}{2}\right)$ where, m_a is the modulation index.	3
	c)	What is meant by the term Frequency Deviation? Draw the waveform generated by frequency modulation.	3
3.	a)	Draw and explain the block diagram of an FM Transmitter.	4
	b)	Draw pre-emphasis and de-emphasis circuit. Why is it necessary to employ pre-emphasis and de-emphasis in FM system?	5
	c)	Differentiate the terms noise and distortion.	2.67
4.	a)	Classify radio transmitter according to carrier frequency used.	4
	b)	Explain with diagram the operation of SSB transmission system.	3.67
	c)	Briefly explain master oscillator.	4

PART-B

5.	a)	Compare between AM and FM receiver.	4
	b)	Draw and briefly explain the block diagram of a FM broadcast receiver.	4
	c)	What is cross modulation? Calculate cross modulation.	3.67
6.	a)	Mention the spurious responses in radio receiver.	3
	b)	What is meant by AGC? Provide your explanation with appropriate circuit diagram.	4
	c)	Explain the working principle of picture transmission in television system with suitable block diagram.	4.67
7.	a)	What is scanning and interlace scanning?	3.67
	b)	How do you calculate the number of scanning line?	2
	c)	What is composite video signal?	2
	d)	Explain the vestigial sideband transmission with diagram.	4
8.	a)	Explain briefly, how the electron beam is focused on the tube screen. What is meant by crossover point in the electron gun?	4
	b)	How is the illusion of continuity created in television pictures?	3
	c)	Draw and describe the block diagram of television receiver section in details.	4.67

Department of Information and Communication Engineering

Pabna University of Science and Technology

Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019

Session: 2017-2018

Course Code: **ICE-2207** Course Title: **Electromagnetic Fields and waves**

NB:
1. Answer any **SIX**(THREE from each PART) questions.
2. Figures in the right margin indicate full marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the questions of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What is displacement current? And its significance? 2
   b) Find out the expressions: i) $\vec{\nabla} \times \vec{E} = \frac{\partial \vec{B}}{\partial t}$, and ii)$\vec{\nabla}.\vec{B} = 0$, from the fundamental laws of physics. $5\frac{2}{3}$
   c) State and explain pointing theorem. 4

2. a) Define scalar potential and vector potential. 2
   b) Prove that uniform plane electromagnetic waves are transverse in nature $6\frac{2}{3}$
   c) Explain the physical significance of Maxwell's field equations. 3

3. a) What do you mean by depth of penetration? 2
   b) Derive the equation of propagation of the plane electromagnetic wave in the perfect dielectric medium. $6\frac{2}{3}$
   c) Deduce the equation of Lorentz's Lemma. 3

4. a) Define ground wave and sky wave. 2
   b) Show that $\mu = \sqrt{1 - \frac{81N}{f^2}}$, where the symbols have their usual meanings. $6\frac{2}{3}$
   c) At what frequency, a wave must be propagated for the D region to have an index of refraction 0.5? Given N=400 electron/cc for D region. 3

PART-B

5. a) Define Brewster angle and Critical angle. 2
   b) Explain the total internal reflection of Electromagnetic waves. 3
   c) Deduce Fresnel's equation at the boundary of two dielectrics for an electromagnetic wave polarized with its $\vec{E}$ vector normal to the plane of incidence. $6\frac{2}{3}$

6. a) Bring out the difference between E-wave and H-wave. 3
   b) Deduce the equation of characteristics impedance of an infinite transmission line. $5\frac{2}{3}$
   c) A high-frequency transmission line consists of a pair of open wires having a distributed capacitance of 0.01μF/Km and a distributed inductance of 3mH/Km. What are the characteristics of impedance and propagation constant at f = 10MHz? 3

7. a) What are the types of line distortions? Show that when the series resistance R and the shunt capacitance C of a transmission line are small but not negligible, the attenuation constant may be written as $6\frac{2}{3}$

$$\alpha = \frac{R}{2}\sqrt{\left(\frac{C}{L}\right)} + \frac{G}{2}\sqrt{\left(\frac{L}{C}\right)}.$$

   b) Define propagation constant. What are the values of SWR for open circuits, short circuits, and matched load? 3
   c) What is the input impedance of an open-circuited lossless transmission line if the length of the line is (i)$\lambda/4$ (ii)$\lambda/2$and (iii)$3\lambda/4$ 2

8. a) What do you mean by circular waveguide? 2
   b) Explain $TE_{m,n}$ and $TM_{m,n}$ for a rectangular waveguide. $6\frac{2}{3}$
   c) Why TEM waves cannot propagate through a rectangular waveguide? 3

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019

Session: **2017-2018**

Course Code: **ICE-2205** Course Title: **Signals and Systems**

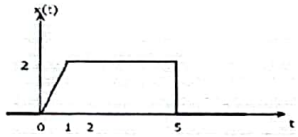
NB:
1. Answer any **SIX (THREE from each PART)** questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define signal. What are the major classifications of signal? 1.67
   b) Define energy and power of a signal. Find the energy and power of the signal, $x(t) = r(t) - r(t-2)$. 5
   c) What is digital signal processing? Write down the advantages of digital signal processing over analog signal processing. 5

2. a) Explain the operations performed on dependent variable of a signal. 6.67
   b) Define ramp function. Express the following signal with unit step and ramp function. 2



   c) Sketch the all possible representation following the output-input relationship $y[n] = \frac{1}{3}(x[n] + x[n-1] + x[n-2])$. 2
   d) Write the precedence rule for performing time-shifting and time scaling of a signal. 1

3. a) What do you understand by LTI system? 1.67
   b) Express the given signal sequences as a time-shifted impulse. 3

$$(i)\ x(n) = \left\{1,\ -2,\ 8,\ \underset{\uparrow}{4},\ 5,\ -3,\ 7\right\}$$

$$(ii)\ x(n) = \left\{2,\ 3,\ \underset{\uparrow}{0},\ 7,\ 8,\ -15,\ 18,\ 20\right\}$$

   c) An LTI system has impulse response $h(n)$.Determine the output for this system in response to$x(n)$ using direct approach, where 5

$$h(n) = \begin{cases} 1, & n = \pm 1 \\ 2, & n = 0 \\ 0, & \text{Otherwise} \end{cases} \quad \text{and} \quad x(n) = \begin{cases} 2, & n = 0 \\ 3, & n = 1 \\ -2, & n = 2 \\ 0, & \text{Otherwise} \end{cases}$$

   d) Write the Invertibility property of the system with an example. 2

4. a) Let $x(t) = 2u(t-1) - 2u(t-3)$ and $h(t) = u(t+1) - 2u(t-1) + u(t-3)$. Find the convolution integral of the sequences. 6
   b) What do you mean by circular convolution? Using the Circle method write the steps for computing circular convolution of two data sequences. 3
   c) Find the circular convolution of two data sequences $x_1(n) = \{1, 2, -3, 4, -5\}$; $x_2(n) = \{-2, 4, 6\}$ using matrix method. 2.67

PART-B

5.	a)	Explain DTFS. Deduce its pair expression.	3
	b)	Find the DTFS of the signal $x(n) = \{\underset{\uparrow}{0.5}, 1, -4, 0, 0\}$.	3
	c)	Deduce the expression for DTFT.	5.67
6.	a)	Explain how aperiodic signals can be represented by Fourier ~~series~~ transform.	4
	b)	Find the DTFT of the sequences i)$x(n) = \alpha^n u(n), where\ \alpha = 0.5$, and (ii) $x(n) = 2(3)^n u(-n)$.	4
	c)	What is meant by sampling? State sampling theorem.	3.67
7.	a)	Find the convolution of the sequences $h(n) = \left(\frac{1}{2}\right)^n u(n)$ and $x(n) = \left(\frac{1}{3}\right)^n u(n)$, using convolution property of DTFT.	3.67
	b)	Write the process of performing Fourier transform of an analog signal $x(t)$ by using digital computers.	4
	c)	Deduce the DIT algorithm for a 4-point sequence, i.e., $N = 4$.	4
8.	a)	Explain DFT and Its Inverse	2
	b)	Describe matrix representation of DFT.	4.67
	c)	Find 4-point DFT and IDFT for the given data sequence $x(n) = \{1, 2, 1, 1\}$.	5

Department of Information and Communication Engineering

Pabna University of Science and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2019

Session: **2017-2018**

Course Code: **Math-2201** Course Title: **Complex Analysis, Laplace, Fourier Transform**

NB: 1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the questions of **PART-A** and **PART-B.**

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define complex number, absolute of complex number and modulus of complex number with examples. 3

   b) For complex number prove that $|z_1 z_2| = |z_1|\,|z_2|$. Given a complex number (vector) z, explain geometrically $ze^{i\alpha}$, where α is real. 4

   c) Define analytic function at a point. Explain various types of singularities with examples. $4\frac{2}{3}$

2. a) Define harmonic function. Prove that the function $u = 2x(1-y)$ is harmonic, find the complex conjugate v of the u such that $f(z) = u + iv$ is analytic and also evaluate $f(z)$ in terms of z. 4

   b) If $f(z) = u(x,y) + iv(x,y)$ is analytic in a region R, prove that u and v are harmonic in R if they have continuous second partial derivatives in R. 4

   c) Define complex line integral, simply connected region, multiply connected region. Establish the connection between real and complex line integrals. $3\frac{2}{3}$

3. a) State and prove Cauchy integral formulae. 4

   b) Evaluate $\oint_C \frac{e^z}{(z^2+\pi^2)^2} dz$, where C is the circle $|z| = 4$. 3

   c) State Morera's theorem. Evaluate $\oint_C \frac{dz}{z-1}$ around (i) the circle $|z-2| = 4$, (ii) the circle and (iii) the square with vertices at $1 \pm i, -1 \pm i$. $4\frac{2}{3}$

4. a) Applying calculus of residues prove that $6\frac{2}{3}$

$$\int_{\infty}^{\infty} \frac{dx}{(1+x^2)^2} = \frac{\pi}{4}$$

   b) Define conformal bilinear mappings. Show that $w = \frac{1}{z}$ maps the exterior of the unit circle in z-plane and inside the unit circle of w-plane (sketch the map only). 5

PART-B

5. a) Define Laplace transformation. State and prove first shifting properties of Laplace transform. 3

b) Evaluate the Laplace transform problems: (i) $\ell\{t\}$, (ii) $\ell\{e^{at}\}$ and (iii) $\ell\{\sin at\}$. 4

c) If $\ell\{F(t)\} = f(s)$, then show that $\ell\{F(at)\} = f(s/a)/a$. Mention the name of this property. 3

d) Evaluate $\ell\{t^2 \cos at\}$. $1\frac{2}{3}$

6. a) Show that $\ell\{Y'(t)\} = sy(s) - Y(0)$, where $y(s)$ is Laplace transform of $Y(t)$. 2

b) Define inverse Laplace transform. Evaluate (i) $\ell^{-1}\{\frac{1}{s+1}\}$ and (ii) $\ell^{-1}\{\frac{s}{(s-b)^2+a^2}\}$. $3\frac{2}{3}$

c) Find the Laplace transform of the integral problem $\int_0^t \frac{\sin t}{t} dt$. 2

d) Solve the differential equation $y' + 2y = e^t$; $y(0) = 1$ by using Laplace transform. 4

7. a) Define periodic, odd and even function with examples.

b) Explain the Fourier series. Expand the function $f(x) = x/2$ in Fourier series over the interval $[0, 2\pi]$. Identify the series. 4

c) ~~Expand the function $f(x) = x/2$~~ in Fourier series: $f(x) = \begin{matrix} \pi + x; & -\pi < x < 0 \\ \pi - x; & 0 < x < \pi \end{matrix}$ and deduce $4\frac{2}{3}$

$$\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots \quad \cdots$$

8. a) Develop $f(x) = \frac{1}{\pi}\int_0^\infty du \int_\infty^\infty f(t) \cos u(x-t) dt$ $3\frac{2}{3}$

b) Find the Fourier Transform of the function 4

$$F(x) = \begin{cases} 1 - x^2 & when\ |x| < 1\ or\ -1 < x < 1 \\ 0 & when\ |x| > 1\ or\ -1 > x > 1 \end{cases}$$

c) Using the Fourier Transform solve the problem: 4

$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$; $u(0,t) = 0$, $u(\pi,t) = 0$, $u(x,0) = 2x$ where $0 < x < \pi, t > 0$.

Department of Information and Communication Engineering

Pabna University of Science and Technology

Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2019

Session: 2017-2018

Course Code: **STAT-2201** Course Title: **Sampling Distribution and Hypothesis Testing**

NB:
1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate full marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the questions of **PART-A** and **PART-B**.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define sampling distribution. Show that chi-square (χ^2)distribution is a sampling distribution of normal distribution. 4
   b) Show that variance of χ^2 distribution is twice of the mean of χ^2 distribution. 4
   c) Write down the properties of student't distribution. 3.67

2. a) Define F- distribution. If we draw two independent samples of size n_1 and n_2 respectively from two normal populations with the same variance than $\frac{S_1^2}{S_2^2} \sim F(n_1 - 1, n_2 - 1)$. 5.67
   b) Establish the interrelationship between t, χ^2 and F statistic. 6

3. a) What do you understand by Point Estimation? When would you say that estimate of a parameter is good? 3.67
   b) Discuss the terms i) estimate, ii) consistent estimate, iii) unbiased estimate, of a parameter, and show that sample mean is both consistent and unbiased estimate of the population mean. 5
   c) Sample variance is consistent but biased estimator for population variance, justify. 3

4. a) Define maximum likelihood function with an example. 2
   b) What are the methods of finding an estimator? Describe any one method. 5
   c) If $X_1, X_2, \ldots \ldots X_n$ be a random sample of 'n' observation from the Poisson population with parameter θ. Find the MLE of θ. 4.67

PART-B

5. a) Define test of Hypothesis, one-tailed test, two-tailed test, and level of significance. 4
   b) Describe the test procedure of equality of two means. 3
   c) The numbers of computer scientists coming out from two different universities A and B are employed in different organizations to do the job related to computers 4.67

University	Number of graduates employed
A	17, 15, 13, 20, 22, 25
B	10, 18, 33, 15, 12, 18, 27

   Do you think that the employment facility for both the universities is similar?

6. a) What do you mean by best critical region and most powerful test? 2
   b) State the Neyman-Pearson theorem. Discuss the role of this theorem in hypothesis testing 3.67
   c) Suppose the observations 15, 28, 3, 12, 19, 20, 2, 25, 30, 62, 12, 18, 16, 27, 33, 36, 41, 9, 21, 12, 26, 4, 65 have come from an exponential distribution with mean θ. Perform an MP test of size $\alpha = 0.05$ for testing $H_0: \theta = 20$ vs $H_1: \theta = 23$. 6

7. a) What do you mean by the test of independence? Describe the test of independency procedure of 2 ×2 contingency table. 4.67

b) A survey on the professor of 125 persons was conducted to see whether their occupation was associated with their fathers's occupation. The following results were obtained 7

		Son's occupation		
		Agriculture	Business	Service
Father's occupation	Agriculture	25	5	15
	Business	10	19	16
	Service	4	3	28

Test the hypothesis that son's occupation is independent of father's occupation.

8. a) Distinguish between parametric and non-parametric tests. 3

b) Describe the Wilcoxon singed-rank test for dependent populations. 4

c) Eight observations were randomly selected from two populations that were not normally distributed. Use the 0.05 significance level, the Wilcoxon rank-sum test to determine whether there is a difference between two populations 4.67

Population A: 38, 45,56,57,61,69,70,79

Population B: 26,31,35,42,51,52,57,62

Pabna University of Science and Technology
Department of Information and Communication Engineering
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2020
Session: 2018-2019

Course Code: **ICE-2201** Course Title: **Data Structure and Algorithm**

NB: 1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Consider the pattern $P = aaabb$. Construct the table and the corresponding labeled directed graph used in the "fast" pattern matching algorithm. 6

b) Suppose A is a sorted array with 300 hundred elements, and suppose a given element x appears with the same probability in any place in A. Find the worst case running time $f(n)$ and the average case running time $g(n)$ to find x in A using the binary search algorithm. 5.67

2. a) Let Q be an empty queue and S an empty stack. If elements A1, A2, A3 are placed in the queue and elements A4 and A5 are pushed onto the stack, and if all the elements from the queue are then dequened and placed onto the stack, which element is on the top of the stack? Finally, depict the contents of S and Q 2.5

b) Consider the following arithmetic expression in postfix notation: 4

7 5 2 + * 4 1 5 - / -

i) Find the equivalent prefix form of the above by showing the state of the stack and other variables as they change.

ii) Obtain the computed value of the expression from its postfix notation.

c) *What is recursion? Let J and K be integers and suppose $Q(J, K)$ is recursively defined by*

$$Q(J,K) = \begin{cases} 5 & if\ J < K \\ Q(J-K, K+2) + J & if\ J \geq K \end{cases}$$ 2.5

Find $Q(2,7), Q(5,3)$.

d) Explain queue underflow and overflow with suitable illustration. 2.67

3. a) Draw all the possible dissimilar trees T where: 6
i) T is a binary tree with 3 nodes ii) T is a 2-tree with 4 external nodes

b) Explain the process of polyphase merge sort. 5.67

4. a) Define binary tree and complete binary tree with example. 3.67

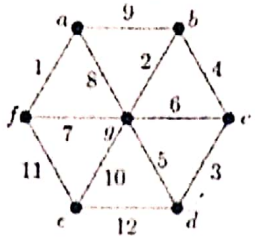
b) Construct a 3-way search tree for the list of keys in the order shown below. What are your observations? 4
List A: 10, 15, 20, 25, 30, 35, 40, 45
List B: 20, 35, 40, 10, 15, 25, 30, 45

c) Apply selection sort algorithm to sort the following elements: 4
77, 33, 44, 11, 88, 22, 66, 55, 99

PART-B

5. a) From a computational viewpoint, is it easy or hard to find the chromatic polynomial of an arbitrary graph? Explain. 3

b) Consider the following edge-weighted graph. 4.67



i) Use the greedy algorithm to find a minimum-weight spanning tree of this graph. What is the weight of such a spanning tree? Show your working.

ii) How would you modify the greedy algorithm to find a maximum-weight spanning tree? No justification is necessary, but the modification needs to be clearly explained.

c) Consider following instance for simple knapsack problem. Find the solution using greedy method. 4

N=8;

P={11, 21, 31, 33, 43, 53, 55, 65}

W={1, 11.21, 23, 33, 43, 45, 55}

M=110

6. a) Apply Greedy method to solve the optimal storage on tapes problem if $n = 3$ and $(l_1, l_2, l_3) = (5,10,3)$. 5

b) What are differences between Prim's algorithm and Kruskal's algorithm? 2

c) Explain how job sequencing with deadline problems can be solved using the Greedy approach. 4.67

7. a) Write the general procedure of dynamic programming. State the principle of optimality. 3.67

b) Solve the all pairs shortest path problem for the digraph with the following weight matrix. 6

$$\begin{bmatrix} 0 & 2 & \infty & 1 & 8 \\ 6 & 0 & 3 & 2 & \infty \\ \infty & \infty & 0 & 4 & \infty \\ \infty & \infty & 2 & 0 & 3 \\ 3 & \infty & \infty & \infty & 0 \end{bmatrix}$$

c) State the 0/1 knapsack problem. 2

8. a) State and explain Graph coloring problem? How backtracking approach is useful for assigning different colors to adjacent vertices? 5

b) Briefly Explain the concept of backtracking. 2

c) Solve 8-queen's problem for a feasible sequence $(8, 2, 5, 3)$. 4.67

Pabna University of Science and Technology
Department of Information and Communication Engineering
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2020
Session: 2018-2019
Course Code: **ICE-2203** Course Title: **Analog Communication**

NB: 1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define modulation. What are the needs for modulation in communication system? 03
   b) Draw the block diagram of a typical A.M. superheterodyne receiver and explain the function of each stage. 04
   c) Describe the term "channel" as applied to a communication system. 2.67
   d) Find the minimum length of antenna used to transmit a radio signal of frequency of 30MHz. 02

2. a) Give a short definition and explanation of noise figure. 03
   b) Prove that the equivalent noise temperature $T_{eq} = T_0(F-1)$. 04
   c) Define Noise. Briefly describe the different types of extra-terrestrial noise. 4.67

3. a) Write expression for the sinusoidal carrier voltage which has been frequency modulated by another sinusoidal modulating voltage. 4.67
   b) Which is more immune to noise between AM and FM? 04
   c) A radio telephone transmitter using amplitude modulation has unmodulated carrier output power of *20kW* and can be modulated to a maximum depth of 60% by a sinusoidal modulating voltage without causing overloading. Find the value to which unmodulated carrier power may be increased without resulting in overloading if the maximum permitted modulation index is restricted to *80%*. 03

4. a) Give the classification of Radio Transmitters according to the type of service involved. 3.67
   b) Distinguish between Radio broadcast transmitters and Radio Telephone transmitter. 03
   c) Draw the block diagram of phase cancellation SSB generator. State its drawback. 05

PART-B

5. a) Define selectivity, sensitivity, fidelity and image frequency in radio receiver. 04
   b) Draw the block diagram of superheterodyne receiver and state the function of each block. 4.67
   c) Describe the process to create motion picture using principle of persistence of vision with appropriate diagram. 03

6. a) Draw and explain the operation of Amplitude Limiter. Give salient features of Amplitude Limiter 04
   b) How is the illusion of continuity created in television pictures? Why has the frame reception rate been chosen to be 25 and not 24 as in motion pictures? 04
   c) What is a raster and how is it produced on the picture tube screen? 3.67

7. a) Justify the choice of rectangular frame with width to height ratio = 4/3 for television transmission and reception. 3.67
   b) Justify the choice 625 lines of TV transmission. 04
   c) Why are synchronizing pulses transmitted along with the picture signal? What is flicker and how it is solved in television scanning? 04

8. a) What is the function of aquadag coating on the inner side of the picture tube? 03
   b) Draw and briefly explain the block diagram of AGC system. 04
   c) Discuss the factors influencing the choice of intermediate frequencies in TV receivers. 4.67

Department of Information and Communication Engineering

Pabna University of Science and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2020

Session: 2018-2019

Course Code: **ICE-2205** Course Title: **Signals and Systems**

NB: 1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

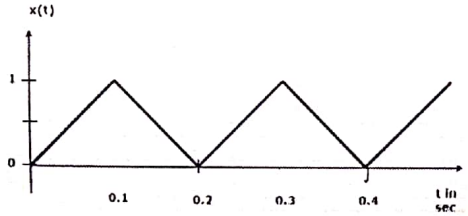
Time: 3 Hours (For Part A and Part B) **Total Marks: 70**

PART-A

1. a) Define one dimensional and multi-dimensional signals. 2

   b) Classify signal. Define each of them with suitable examples. $6\frac{2}{3}$

   c) Determine whether the following signal is energy or power signal. Also determine average power and energy of the signal. 3



2. a) Write the steps of A/D conversion. Explain each of them with examples. $3\frac{2}{3}$

   b) Classify each of the following as periodic or non-periodic. If periodic, find the fundamental period of that signal. 4

   i) $x[n] = 5sin(2n)$

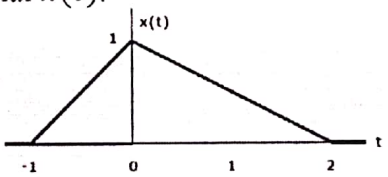
   ii) $x[n] = \sin(\frac{2\pi}{3})n$

   iii) $x[n] = 5sin(0.2\pi n)$

   iv) $x[n] = e^{j5\pi n}$

   c) Explain the operations performed on independent variable of a signal. 4

3. a) Find $x(2t-1)$ of the given signal $x(t)$. $2\frac{2}{3}$



   b) Define the following elementary signals: i) Ramp Signals, (ii) Exponentially Damped Sinusoidal Signals. 2

   c) Define Impulse Response. Explain following properties of systems: (i) Memory, (ii) Time invariance, and (iii) Linearity with examples. 4

   d) Determine the following systems are time-invariant or not: i) $y(t) = tx(t)$, and ii) $y(t) = x(4t)$. 3

4. a) Prove that the recursive system defined by the difference equation $v(n) = av(n-1) + x(n)$ is linear. 5

   b) What do you mean by circular convolution? Using circle method write the steps for computing circular convolution of two data sequences. 4

   c) Find the circular convolution of two data sequences $x_1(n) = \{1, 2, -3, 4, -5\}$; $x_2(n) = \{-2, 4, 6\}$ using matrix method. $2\frac{2}{3}$

PART-B

5. a) What do you understand by Fourier representation of signals? 2
   b) Explain DTFS. Also find its pair. 3
   c) Consider the following signal $6\frac{2}{3}$
   $x(n) = \{\ldots\ 0.5\ \ 1\ \ -0.5\ \ 0\ \ 0\ \ 0.5\ \ \underset{\uparrow}{1}\ \ -0.5\ \ 0\ \ 0\ \ 0.5\ \ 1\ \ -0.5\ \ \ldots\}$.
   Find the DTFS of the signal $x(n)$.

6. a) Explain DTFT of a Rectangular Pulse. $6\frac{2}{3}$
   b) Find the DTFT of the sequences: i) $x(n) = \alpha^n u(n), where\ \alpha = 0.5$, and (ii) $x(n) = 2(3)^n u(-n)$. 5

7. a) Briefly explain the periodicity, linearity, and symmetry properties of DFT. 5
   b) Find the convolution of the sequences i) $h(n) = \left(\frac{1}{2}\right)^n u(n)$ and $x(n) = \left(\frac{1}{3}\right)^n u(n)$, $6\frac{2}{3}$
   ii) $h(n) = \alpha^n u(n), |\alpha| < 1$, and $x(n) = \beta^n u(n), |\beta| < 1$ using convolution property of DTFT.

8. a) Explain DFT and Its Inverse. 2
   b) Describe matrix representation of DFT. $4\frac{2}{3}$
   c) Find 4-point DFT and IDFT for the given data sequence $x(n) = \{0,\ 1,\ 2,\ 3\}$. 5

Department of Information and Communication Engineering
Pabna University of Science and Technology
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2020
Session: 2018-2019

Course Code: **ICE-2207** Course Title: **Electromagnetic Fields and Waves**

NB: 1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define Vector potential and Retarded potential. 02
   b) Deduce the wave equation for scalar potential. 04
   c) Derive the expressions $\vec{\nabla} \times \vec{E} = -\mu \frac{\partial H}{\partial t}$ 5.67

2. a) Using Maxwell's equations derive the wave equation for magnetic field in free space. 04
   b) Show that E and H are mutually perpendicular to each other and dependence on medium. 5.67
   c) What is Lorentz's Lemma? 02

3. a) Define intrinsic impedance and propagation constant. 02
   b) What is Pointing Theorem? Establish the relationship among instantaneous, average and complex pointing vector. 7.67
   c) A plane travelling wave in free space has an average Pointing vector of $1\ W/m^2$. Find the average energy density. 02

4. a) Explain the different mode of propagation of EM wave. 03
   b) Derive the expression for the refractive index of the ionosphere. 5.67
   c) How electrical properties of earth affect the surface wave propagation? 03

PART-B

5. a) Deduce Fresnel's equation at the boundary of two dielectrics for an electromagnetic wave polarized with its $\vec{E}$ vector parallel to the plane of incidence. 6.67
   b) Explain total internal reflection of Electromagnetic wave. 02
   c) Calculate the Brewster angles for the following cases; 03
   i) Light incident on a glass whose index of refraction is 1.6
   ii) Radio frequency wave incident on water (n=8).

6. a) Derive the voltage and current equation for a transmission line. 5.67
   b) Determine the condition for distortion less line. 03
   c) A transmission line has the following constants: 03
   R = 10.4 Ω, L = 3.666 mH, C = 0.00835 μF and G = 0.08 μ mhos. Calculate Z_0 at ω = 5000 radians/Sec.

7. a) Give the concept on impedance matching through transmission line. 03
   b) Explain the difference in the mechanism of propagation of electromagnetic energy in the waveguide and along a transmission line. 5.67
   c) A rectangular waveguide has dimensions of 1×2 cm². Find the cut-off frequency for $TE_{1,0}$, $TE_{1,1}$ mode. 03

8. a) Define the terms i) Guided wave ii) Microstrip lines iii) Wave guide tees. 03

b) Derive the equations for α and β in terms of primary constant. 5.67

c) A 6 GHz signal is to be propagated in the dominant mode in a rectangular waveguide. If its group velocity is to be 90% of the free space velocity of light; What must be the breadth of the waveguide? 03

Pabna University of Science and Technology
Department of Information and Communication Engineering
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2020
Session: 2018-2019
Course Code: **Math-2201** Course Title: **Complex Analysis, Laplace and Fourier Transforms**

NB: 1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define complex number and Complex variable function with examples. 2
b) What are analytic function and Cauchy Riemann equations? Find k, such that $\frac{1}{2}\log(x^2+y^2)+i\tan^{-1}(\frac{kx}{y})$ is analytic. 4
c) If $f(z)$ is an analytic function with constant modules, show that $f(z)$ is constant. 3
d) Let $A(1,-2)$, $B(-3,4)$ and $C(2,2)$ be the three vertices of triangle ABC. Find the length of the median from C to the side AB. 2.67

2 a) Find the Laurent expression of $f(z)=\frac{7z-2}{(z+1)z(z-2)}$ in the region $1<z+1<3$. 4
b) What is Cauchy's integral Formula? Use Cauchy's integral Formula to Evaluate $\int_C \frac{z}{z^2-3z+2}dz$, where C is the circle $|z-2|=\frac{1}{2}$. 4
c) What are regular point, singular point and isolated singularity with examples? 3.67

3. a) What are the real integration and complex integration? Evaluate $\int_C |z|dz$, where C is the left half of unit circle, $|z|=1$ from $z=-i$ to $z=i$. 5.67
b) Evaluate: $\int_C \frac{2z+3}{z}dz$, where C is i. Upper half of circle $|z|=2$. ii. Lower half of circle $|z|=2$. iii. Whole circle in anticlockwise direction. 6

4. a) What are Mapping and Conformal mapping? Let the transformation $w=z+(1-i)$ and in z-plane: the region D is covered by $x=0$, $y=0$, $x=1$ and $y=2$, then find the region D' in w-plane corresponding to D in z-plane. 4.67
b) What is Bilinear transformation? Find the Bilinear transformation which maps the points $i, -i, 1$ of z-plane into $0, 1, \infty$ of W-plane. 5

c) Find the image of circle $|z| = 2$ under the transformation w=3z. 2

PART-B

5. a) What do you mean by Fourier series, even function, odd function and periodic function? Evaluate the coefficients of Fourier series. 6.67

b) Represent the Fourier series of the following function: 5

$$f(x) = \begin{cases} 0, & -\pi \le x \le 0 \\ x & 0 \le x \le \pi \end{cases}$$

6. a) Define Fourier sine and cosine integrals. Express $f(x) = \begin{cases} 1; & 0 \le x \le \pi \\ 0; & x > \pi \end{cases}$ 4.67

as a Fourier sine integral and hence evaluate

$$\int_0^\infty \frac{1-\cos(\omega\pi)}{\omega}\sin(\omega x)\,d\omega$$

b) An infinite string is initially at rest and that the initial displacement is $f(x), -\infty < x < \infty$. Use Fourier transform to determine the displacement $u(x,t)$ of the string govern by 7

$$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial t^2}$$

7. a) Define Laplace transformation and inverse Laplace transformation. Find 5.67

$$L^{-1}\{\frac{a^3}{s(s+a)^3}\}.$$

b) State and prove the existence theorem of the Laplace transformation. 4

c) If $L\{F(t)\} = f(s)$, then $L\{e^{at}F(t)\} = f(s-a)$. 2

8. a) State and Prove the convolution theorem for Laplace transformation. 5.67

b) What is Laplace transformation of derivatives? Using Laplace transformation find the solution of the equation $X''(t) - 4X'(t) + 4X(t) = 4e^{-2t}$ with boundary conditions X(0)=0, $X'(0) = 1$. 6

Pabna University of Science and Technology
Department of Information and Communication Engineering
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2020
Session: 2018-2019
Course Code: **Stat-2201** Course Title: **Sampling Distribution and Hypothesis Testing**

NB: 1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) What do you understand by statistical inference? Discuss different types of statistical inference. 4
   b) How to assess quality of estimators? Why mean is more efficient estimator than median for normal population? 3
   c) Define mean square error (MSE) consistency. If $f(x) = \theta^x(1-\theta)^{1-x}, x = 0,1$ then show that point estimator of θ is unbiased and consistent estimator. 4.67

2. a) What are the methods of finding point estimation? Discuss about Maximum likelihood estimation (MLE) method of point estimation. 5
   b) Find MLE of exponential distribution, $f(x,\theta) = \theta e^{-\theta x}$, 0<x<∞. Check whether likelihood estimator is unbiased and consistent estimator of θ. 6.67

3. a) Define sampling distribution. How does it differ from parent distribution? 4
   b) Write down the probability density function (pdf) of χ^2 – distribution with n degrees of freedom. Obtain moment generating function (mgf) of this distribution and hence or otherwise find skewness and kurtosis. 5.67
   c) Mention some uses of χ^2 – distribution. 2

4. a) Define χ^2 distribution. State and prove additive property of χ^2 distribution. 4
   b) If x is drawn from a normally distributed population N (μ, σ²), then show that the sample variance s^2 has distribution $\frac{\sigma^2}{n-1}\chi^2_{(n-1)}$. 4
   c) Define F-distribution. If you draw two independent samples of size n_1 *amd* n_2 respectively from two normal population with the same variance then show that $\frac{S_1^2}{S_2^2} \sim F(n_1-1, n_2-1)$. 3.67

PART-B

5. a) What is statistical hypothesis testing? How does it differ to estimation? 2
   b) Define i) Simple hypothesis ii) Composite hypothesis iii) Level of significance iv) Degrees of freedom v) P-value. 5
   c) A manufacturer claims that the average capacity of a certain type of battery the company produces is at least 140 ampere-hours. An independent consumer protection agency wishes to test the credibility of the manufacture's claim and 4.67

measures the capacity of 12 batteries from a recently produced batch. The results are as follows:

137.4 140.0 138.8 139.1 144.4 139.2 141.8 137.3 133.5 138.2 141.1 139.7

Test the hypothesis $H_0: \mu > 140$ using the 0.05 level of significance.

6. a) What is contingency table? For $r \times c$ contingency table show that the test statistic χ^2 has $(r-1)(c-1)$ degrees of freedom. 6

b) A company is considering two different television advertisements for promotion of a new product. Management believes that advertisement A is more effective than B. In a survey they found that a random sample of 60 customers who saw advertisement A, 18 tried the product and 100 customers who saw advertisement B, 22 tried the product. Is advertisement A more effective than advertisement B, if a 5% level of significance is used? 5.67

7. a) What is chi-square test of independence? How to perform chi-square test of independence? 5

b) At a school in Paris, it is believed that favorite film genre is related to favorite subject. 500 students were asked to indicate their favorite film genre and favorite subject from a selection and the results are indicated in the table below. 6.67

	Comedy	Action	Romance	Thriller
Math	51	52	37	55
Sports	59	63	41	33
Geography	35	31	28	15

Use a χ^2 test, at the 1% level of significance, to investigate whether there is any association between two attributes.

8. a) Define non-parametric test. Listed out a few main types of non-parametric test. 3

b) A teacher taught a new topic in the class and decided to take a surprise test on the next day. The marks out of 10 scored by 6 students were as follows:

Student	1	2	3	4	5	6
Marks	8	6	4	2	5	6

Now, the teacher decided to take the test again after a week of self-practice. The scores were 5

Student	1	2	3	4	5	6
Marks	6	8	8	9	4	10

In the table above, there are some cases where the students scored less than they scored before and in some cases, the improvement is relatively high (Student 4). Analyze if the difference is systematic or due to chance using test.

c) Write down some application, advantages and disadvantages of non-parametric test. 3.67

Department of Information and Communication Engineering

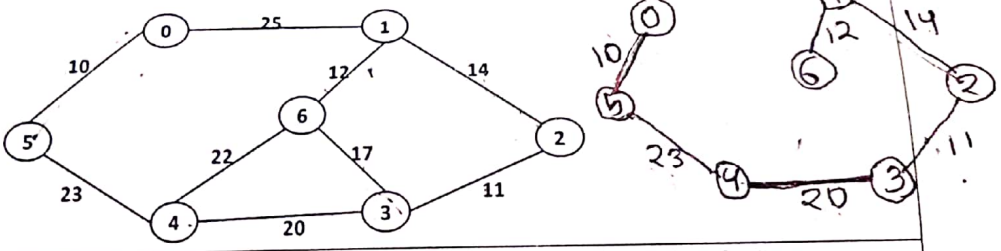
Pabna University of Science and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination 2020

Session: 2018-2019

Course Code: **ICE-2202** Course Title: **Data Structure and Algorithm Sessional**

Time: 4 Hours **Marks: 60**

SN	Problem Description
1.	Write a Program to insert and delete an element into a linear array.
2.	Write a program to sort a linear array using bubble sort algorithm.
3.	Write a program to find an element using linear search algorithm.
4.	Write a program to find an element using binary search algorithm.
5.	Merge sort (also commonly spelled mergesort) is an O(n log n) comparison-based sorting algorithm. This algorithm typically follows divide-and-conquer approach. Write a program to implement this algorithm and test the program for the following elements {20, 4, 56, 79, 1, 22, 35, 69}.
6.	Write a program to sort a linear array using selection Sort algorithm.
7.	Write a program to find a given pattern from text using first pattern matching algorithm.
8.	The eight queen's puzzle is the problem of placing eight chess queens on an 8×8 chessboard so that no two queens attack each other. Thus, a solution requires that no two queens share the same row, column, or diagonal. The eight queen's puzzle is an example of the more general n-queens problem of placing n queens on an n×n chessboard, where solutions exist for all natural numbers n with the exception of 2 and 3. Write a program to solve the n-queens problem.
9.	Kruskal's algorithm is a greedy algorithm in graph theory that finds a minimum spanning tree for a connected weighted graph. Implement Kruskal's algorithm and find the minimum spanning tree for the following graph. 
10.	Job sequencing with deadlines problem follow the following rules to obtain the feasible solution: • Each job takes one unit of time. • If job starts before or at its deadline, profit is obtained, otherwise no profit. • Goal is schedule jobs to maximize the total profit. Write a program using greedy method to solve this problem when no. of jobs n=7, profits $(P1, P2, P3, \ldots., P7) = (3, 5, 20, 18, 1, 6, 30)$ and deadlines $(d1, d2, d3, \ldots., d7) = (1, 3, 4, 3, 2, 1, 2)$.
11.	Write a program to solve the following 0/1 knapsack problem using dynamic programming approach, profits P=(11, 21, 31, 33), weight W=(2, 11, 22, 15), knapsack capacity C=40 and no. of items n=4.
12.	The Towers of Hanoi is a well-known children's game, played with three poles and a number of different-sized disks. Each disk has a hole in the center, allowing it to be stacked around any of the poles. Initially, the disks are stacked on the leftmost pole in the order of decreasing size, i.e., the largest on the bottom and smallest on the top. Write a program using function to transfer the disks from the leftmost pole to the rightmost pole, without ever placing a larger disk on top of a smaller disk. Only one disk may be moved at a time, and each disk must always be placed around one of the poles.
13.	Write a program to implement queue data structure along with its typical operations.

DEPARTMENT OF INFORMATION AND COMMUNICATION ENGINEERING (ICE)

Pabna University of Science and Technology, Pabna

Course Code: ICE-2204 Course Title: Analog Communication Sessional

Session: 2018-2019 Time: 4.00 Hours Full Marks: 60

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1. Generate an amplitude modulated signal by developing a MATLAB program.
2. Generate a frequency modulated signal by developing a MATLAB program.
3. Generate a phase modulated signal by developing a MATLAB program.
4. Convert an amplitude modulated signal into an amplitude demodulated signal using MATLAB application.
5. Convert a frequency modulated signal into a frequency demodulated signal using MATLAB application.
6. Develop a MATLAB program to analyze the frequency response of the Pre-Emphasis and De-Emphasis circuits.

Answer the following short questions:

1. Write down the disadvantages of PWM.
2. Why is modulation required?
3. Define sampling.
4. What do you understand by Nyquist Rate?
5. Define PAM and write down its drawbacks.

Department of Information and Communication Engineering
Pabna University of Science and Technology
B. Sc. (Engineering) 2nd Year 2nd Semester Final Examination-2020
Session: **2018-2019**

Course Code: **ICE-2206** Course Title: **Signals and Systems Sessional**

Time: 4 Hours Marks: 60

Q1. Write a Matlab/Python code to calculate the DFT or IDFT of a signal.

Q2. Let $x(n) = \{1, 2, 3, 4, 5, 6, 7, 6, 5, 4, 3, 2, 1\}$. Determine and plot the following sequences $x_1(n) = 2x(n-5) - 3x(n+4)$.

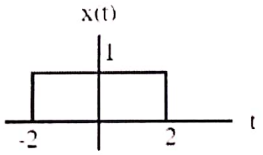
Q3. Write a Matlab/Python Code to perform the following operations: i) Sampling, ii) Quantization, and iii) Coding.

Q4. Determine and plot the following sequence $x(n) = 2\delta(n+2) - \delta(n-4), -5 \leq n \leq 5$.

Q5. Perform the following signal operations: i) Signal addition and ii) Signal folding using MATLAB/Python and plot each of them.

Q6. Perform the following signal operations: i) Signal multiplication and ii) Signal shifting using MATLAB/Python and plot each of them.

Q7. Write a Matlab/Python Code to plot FT of a time function aperiodic pulse shown below



Q8. Write a Matlab/Python Code to find the amplitude spectrum of the two-frequency signal: $x(t) = \cos(2\pi 100t) + \cos(2\pi 500t)$ and also find approximate FT integral for $0 \leq f \leq 800\ Hz$.

Q9. Write a Matlab/Python code to generate: i) sine and ii) cosine signals with different frequencies.

Q10. Explain and implement the following elementary discrete time signals using Matlab/Python: i) Unit sample sequence, ii) Unit step signal, iii) Ramp signal.

Pabna University of Science and Technology

Department of Information & Communication Engineering

B. Sc. (Engineering) 2nd Year 2nd Semester Examination-2020

Course Code:STAT-2202

Full Marks: 40 **Time:** 6 Hours

N.B.:i) The figures in the right margin indicate full marks.

01.		The data contains weight of the 75 members of some imaginary population: 44 59 36 55 47 61 53 32 65 51 29 41 32 45 83 58 73 47 40 26 59 43 66 44 41 25 39 72 37 55 34 47 66 53 55 58 49 45 61 41 55 92 83 77 45 62 45 36 78 48 54 50 51 66 80 73 57 61 56 50 45 82 71 48 46 69 38 72 56 64 38 45 51 44 41 Using R code a) Find the point estimators sample mean and median for the population mean μ using 20 sample. b) Find which point estimator is the best among sample mean and median? Why? c) Construct95% confidence interval for the parameter.	**10**
02.		A school athletics has taken a new instructor, and want to test the effectiveness of the new type of training proposed by comparing the average times of 12 runners in the 100 meters. Before training: 12.9 13.5 12.8 15.6 17.2 19.2 12.6 15.3 14.4 11.3 12.0 15.5 After training :12.7 13.6 12.0 15.2 16.8 20.0 12.0 15.9 16.0 11.1 14.2 11.0 a) Check the normality assumptions using boxplot, Q-Q plot and comment. b) Using the 0.05 level of significance, is there enough evidence that the after training average more than 16.5? draw the decision rule. c) Test the hypothesis that if there was an improvement or deterioration. d) Test the null hypothesis $H_0: \sigma_1^2 = \sigma_2^2$. e) Test also the null hypothesis $H_0: \sigma_1^2 < 5$.	**20**
03.		The following data give the monthly rents (in dollars) paid by a random sample of 30 households selected from a large city 425 960 1450 655 1025 750 670 975 660 880 1250 780 870 930 550 575 425 900 1800 525 1080 950 765 840 545 660 1170 670 730 550 a) Using sign test, test the hypothesis that the median rent in the city is \$690 against the alternative that it is higher with α=0.01. b) Perform Wilcoxon signed rank test and comment.	**10**

Department of Information and Communication Engineering
Pabna University of Science and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2021
Session: **2019-2020, 2017-2018**

Course Code: **ICE-2201** Course Title: **Data Structure and Algorithm**

NB: 1. Answer any **THREE** questions out of four from each PART.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define data structure. Differentiate between linear and nonlinear data structure. 3.67
   b) Let BALANCE [100:500] is a linear array, Base (BALANCE) = 200 and w = 4 words/memory cell. Find LOC (BALANCE [300]) and comment on the indexing property of BALANCE. 2
   c) Write binary search algorithm and compare with linear search algorithm based on complexity. 6

2. a) Define the terms "overflow, underflow, and header linked list". 3.67
   b) Given an integer K, write a procedure with explanation which deletes the K^{th} clement from a linked list. 4
   c) Write a procedure with explanation which adds a given ITEM of information at the middle of a list. 4

3. a) Give that following list of 12 numbers: 6.67
   44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, and 66.
   Use the quick sort algorithm to find the final position of the first number 44.
   b) Write Huffman's algorithm and simulate it with the following data items and weights: 5

Data item:	A	B	F	N	Q
Weight:	22	5	11	19	13

4. a) Build a maxheap from the following numbers: 5
   41, 27, 47, 19, 57, 52, 74, 52.
   b) What is binary tree? Explain its uses. 2
   c) Write a preorder traversing algorithm of a binary tree. 4.67

PART-B

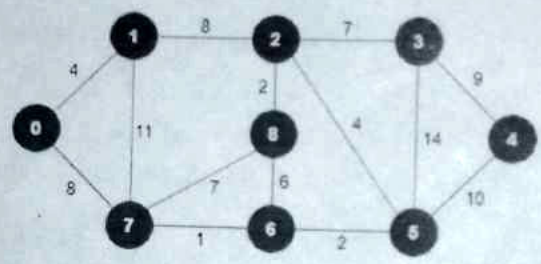
5. a) Define algorithm. What kind of problems are solved by algorithms? 3.67
   b) Analyze insertion sort algorithm for best and average case in terms of time and cost. 4
   c) What is asymptotic notation? For a given function $f(n) = 7n^2 + 5n$ find the big O notation. 4

6. a) Consider the following example of knapsack problem, where single copy of each item is available. 5.67

	weight	value
Item 1	1	5
Item 2	2	11
Item 3	3	18
Item 4	4	22

For M =5, which items should be picked to get optimal solution and what will be the total value?

b) i) For the given graph, find a minimum spanning tree using prims algorithm. 6



ii) Find the total number of possible spanning trees for the given graph.

iii) What is the time complexity of kruskal's algorithm? Which method can be used to reduce this complexity?

7. a) What is dynamic programming? What problems can be solved using dynamic programming? 3.67

b) Define multistage graph. With an example explain the concept of multistage graph. 5

c) What do you mean by shortest path problem? Why it is important in graph theory? 3

8. a) In which cases we have to use backtracking technique? State the main difference between "Backtracking" and "Branch and bound" technique. 2.67

b) The n queens problem is the problem of placing n queens on an nxn chessboard such that no queen can attack another queen. In other words, no two queens share the same row, column or diagonal.
Draw the state space tree to get possible solutions of a 4 queen problem. 6

c) Write an algorithm to find Hamiltonian cycle in a graph. 3

Department of Information and Communication Engineering

Pabna University of Science and Technology, Pabna

Faculty of Engineering and Technology

B.Sc. Engineering 2nd Year 2nd Semester Examination-2021

Session: **2019-2020, 2018-2019, 2017-2018, 2016-2017**

Course Code: **ICE-2203** Course Title: **Analog Communication**

NB:
1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1.	a)	Define Communication. Draw the classification of Radio Frequency Spectrum.	5
	b)	Find the minimum length of antenna used to transmit a radio signal of frequency of 45MHz.	3
	c)	Draw and explain the block diagram of a broadcast transmitter.	3.67
2.	a)	Define signal to noise ratio. What are the sources of noise generation?	4
	b)	Prove that after amplitude modulation, the carrier power increases from P_c to $P_c\left(1+\frac{m_a^2}{2}\right)$ where, m_a is the modulation index.	3
	c)	Differentiate between SNR and Noise Figure. Compute the noise voltage at the input of a video amplifier using a device having 300kΩ equivalent noise resistance and 400Ω input resistor. The bandwidth of the amplifier is 7MHz and the ambient temperature is 27^0C.	4.67
3.	a)	Differentiate the terms noise and distortion.	2.67
	b)	Write expression for the sinusoidal carrier voltage which has been frequency modulated by another sinusoidal modulating voltage.	6
	c)	Which is more immune to noise between AM and FM?	3
4.	a)	Write down the necessary precautions for Master Oscillator operation.	4
	b)	Describe the constituent stages of AM radio transmitter with a suitable block diagram.	3.67
	c)	Define frequency drift. With the help of a block diagram describe the working of a volume compressor.	4

PART-B

5.	a)	Define SSB transmission. Discuss the advantages and disadvantages of SSB system.	4
	b)	With the help of circuit diagram how can be delayed AGC be realized? What are the merits over simple AGC?	3.67
	c)	Write down the main responsibilities of a radio receiver. Differentiate between frequency mixer and frequency converter.	4
6.	a)	Draw and explain the block diagram of a superheterodyne FM receiver.	4
	b)	What is Raster? What do you mean by synchronization for TV system?	3.67
	c)	Draw the simplified cross-sectional view of a Vidicon TV camera tube and explain its operation.	4
7.	a)	Justify the choice of rectangular frame with width to height ratio = 4/3 for television transmission and reception.	3
	b)	How is the illusion of continuity created in television pictures? Why has the frame reception rate been chosen to be 25 and not 24 as in motion pictures?	4
	c)	Draw and describe the block diagram of television receiver section in details.	4.67
8.	a)	How the electron beam is focused on the tube screen? Explain briefly. What is meant by crossover point in the electron gun?	5
	b)	Why screen phosphor is used in Television picture tube?	2.67
	c)	Describe briefly how EHT and boosted B+ voltages are developed from the horizontal output circuit of the sweep amplifier.	4

Department of Information and Communication Engineering

Pabna University of Science and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2021

Session: 2019-2020

Course Code: **ICE-2205** Course Title: **Signals and Systems**

NB: 1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

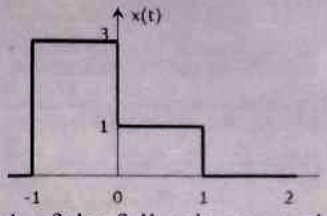
Time: 3 Hours **Total Marks: 70**

PART-A

1. a) Define signals and systems with examples. 2

b) Write the advantages and disadvantages of digital approach over analog signal processing. 2

c) Define even and odd signal. Develop the Even and Odd decomposition of the following $x(t)$. 4



d) Define Sinusoidal signal. Classify each of the following as periodic or non-periodic. If periodic, find the fundamental period of that signal. 3.67

i) $x[n] = 5sin(2n)$
ii) $x[n] = 5sin(6\pi n/35)$
iii) $x[n] = 5sin(0.2\pi n)$
iv) $x[n] = e^{j7\pi n}$

2. a) Write the rules for finding the time shifted and time scaled version of x(t). Give an example. 3.67

b) Explain the operations performed on dependent variable(s) of a signal. 5

c) Express the given signal sequences as a time shifted impulse. 3

$(i)\ x(n) = \left\{1, -2, \underset{\uparrow}{8}, 4, 5, -3, 7\right\}$ $(ii)\ x(n) = \left\{2, 3, \underset{\uparrow}{0}, 7, 8, -15, 18, 20\right\}$

3. a) Derive the relationships between sinusoidal and complex exponential signals. 3.67

b) Define the following functions: 3
(i) Unit step function, (ii) Impulse function, and (iii) Ramp function

c) Express the following signal x(t) with unit step function. 2

$$x(t) = \begin{cases} 5, & -1 \le t \le 2 \\ 0, & Otherwise \end{cases}$$

d) Consider a discrete-time system described by the input-output relationship y[n] = nx[n]. show that this system is linear. 3

4. a) An LTI system has impulse response h(n). Determine the output for this system in response to x(n) using direct approach, where $h(n) = \begin{cases} 1, & n = \pm 1 \\ 2, & n = 0 \\ 0, & Otherwise \end{cases}$ and $x(n) = \begin{cases} 2, & n = 0 \\ 3, & n = 1 \\ -2, & n = 2 \\ 0, & Otherwise \end{cases}$ 4

b) Using circle method, write the steps for computing circular convolution of two data sequences. 2

c) Determine the cross-correlation sequence of the sequences $(n) = \left\{1, 2, \underset{\uparrow}{3}, 4, 5\right\}$; $y(n) = \left\{5, 6, \underset{\uparrow}{7}, 8, 9\right\}$. 5.67

PART-B

5. a) What do you mean by frequency and time domain representation of signal? Why do we need to perform DFT of a discrete time signal? 2

   b) Explain DTFS. Also find its pair. 3

   c) Consider the following signal $x(n) =$ 6.67

   $\{\ldots\ 0\ \ 2\ \ 1\ \ 2\ \ 0\ \ 0\ \ 0\ \ 2\ \ \underset{\uparrow}{1}\ \ 2\ \ 0\ \ 0\ \ 0\ 2\ \ 1\ \ 2\ \ 0\ \ \ldots\}$.

   Find the DTFS of the signal $x(n)$.

6. a) Explain the following properties of DTFT: 7.67

   i) Periodicity,

   ii) Linearity, and

   iii) Convolution property.

   b) State and prove Parseval's relation for continuous time periodic signal. 4

7. a) State and prove the time shifting and frequency shifting properties of DTFT. 5

   b) Find the convolution of the sequences 6.67

   (i) $h(n) = \left(\frac{1}{2}\right)^n u(n)$ *and* $x(n) = \left(\frac{1}{3}\right)^n u(n)$,

   (ii) $h(n) = \alpha^n u(n), |\alpha| < 1$, and $x(n) = \beta^n u(n), |\beta| < 1$ using convolution property of DTFT.

8. a) Prove that DFT is periodic with period N. 3

   b) Describe matrix representation of DFT. Why it is necessary? 4.67

   c) If the DFT sequence is $\{2,\ 1+j, 0, 1-j\}$, what is time sequence? 4

Department of Information and Communication Engineering

Pabna University of Science and Technology, Pabna

Faculty of Engineering and Technology

B.Sc. Engineering 2nd Year 2nd Semester Examination-2021

Session: **2019-2020, 2018-2019, 2016-2017**

Course Code: **ICE-2207** Course Title: **Electromagnetic Fields and Waves**

NB:
1. Answer any **SIX** (THREE from each PART) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART-A

1.	a)	State and explain Coulomb's law of force.	3
	b)	Write down the physical significance of Maxwell equation.	2.67
	c)	Derive the expression $\overline{\nabla}.\overline{D} = \rho$ and $\overline{\nabla} \times \overline{H} = \sigma\overline{E} + \epsilon\frac{\partial \overline{E}}{\partial t}$ where the symbols have their usual meaning.	6
2.	a)	Derive the equation of Lorentz's Lemma. What does it mean?	3
	b)	Compute the intrinsic impedance of plane electromagnetic waves in free space.	6.67
	c)	A plan sinusoidal electromagnetic wave travelling in free space has a maximum electric field intensity of 1500μV/m. Find the accompanying maximum magnetic field intensity.	2
3.	a)	Derive the electromagnetic wave equation in a lossless medium.	6.67
	b)	What is displacement current?	2
	c)	Distinguish between scalar and magnetic vector potentials.	3
4.	a)	Define the term maximum usable frequency.	2
	b)	Discuss in detail the pulse method of measuring the height and electron concentration of an inospheric region.	6.67
	c)	Prove that the skip distance D for a given frequency is given by $$D = 2h\sqrt{\left\{\left(\frac{f}{f_c}\right)^2 - 1\right\}}$$	3

PART-B

5.	a)	Deduce Fresnel's equations with suitable figures for incident wave polarized with **E** vector Normal to the Plane of Incidence.	6.67
	b)	Show that at the Brewster angle between two dielectrics there is no reflected wave if the incident wave polarized with **E** vector parallel to the plane of incidence.	5
6.	a)	Define attenuation constant, phase shift constant and propagation constant.	3
	b)	Deduce the equation of characteristics impedance of an infinite transmission line.	5.67
	c)	A high frequency transmission line consists of a pair of open wires having a distributed capacitance of 0.01μF/Km and a distributed inductance of 3mH/Km. Calculate the characteristic impedance at f=10MHz.	3
7.	a)	Define waveguide and rectangular wave guide.	2
	b)	Derive the field equations for TM mode in rectangular waveguide.	6.67
	c)	A hollow rectangular waveguide has dimensions a=4cm and b=2cm. The frequency of impressed signal is 3GHz. Compute i) cut-off wavelength and ii) guided wavelength for $TE_{1,0}$ modes.	3
8.	a)	Define the terms: i) Smith Chart, ii) Cavity resonators, and iii) Wave guide tees.	3
	b)	Explain the difference in the mechanism of propagation of electromagnetic energy in the waveguide and along a transmission line.	6.67
	c)	Why does the use of waveguides become necessary at microwave frequencies?	2

Pabna University of Science and Technology

Department of Information and Communication Engineering

Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2021

Session: 2019-2020, 2018-2019, 2017-2018

Course Code: **Math-2201** Course Title: **Complex Variable Analysis, Laplace and Fourier Transforms**

NB: 1. Answer any **SIX** (Three from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Total Marks: 70**

PART- A

01. (a) For two complex numbers z and w, show that $|z - w| \geq |z| - |w|$. **04**

(b) Represent graphically the set $\{z \in \mathbb{C}: |z + 1| \leq 5\}$ in complex plane. **04**

(c) Find each of the indicated roots of $(-1 + i)^{\frac{1}{3}}$ and locate those graphically. **3.67**

02. (a) Use $\epsilon - \delta$ definition to show that limit of the function $f(z) = \frac{3z^4 - 2z^3 + 8z^2 - 2z + 5}{z - i}$ is $4 + 4i$ at $z = i$. **04**

(b) Explain the concept of analytic function in complex analysis. **2.67**

(c) Prove that the function $u(x, y) = e^{-x}(x \sin y - y \cos y)$ is harmonic and hence find $v(x, y)$ so that the complex function $f(z) = u(x) + i\, v(y)$ is analytic. **05**

03. (a) If for z in the entire complex plan, $f(z)$ is analytic and bounded, then show that $f(z)$ must be a constant. **05**

(b) State Rouche's theorem. Prove that all the roots of $z^7 - 5z^2 + 12 = 0$ lie between the circles $|z| = 1$ and $|z| = 2$. **04**

(c) State the Augmented theorem for a function $f(z)$ that is analytic inside and on a simple closed curve C except for a pole $z = \alpha$ of order p inside C, and has only one zero $z = \beta$ of order n inside C and no zero on C. **2.67**

04. (a) Expand $f(z) = \sin z$ in a Taylor series about $z = \frac{\pi}{4}$, and determine the region of convergence of this series. **04**

(b) Distinguish between removable singularity and essential singularity. Give example too. **04**

(c) Show that the function $f_1(z) = (z - 3) \sin\left(\frac{1}{z+2}\right)$ has an essential singularity at $z = -2$. **3.67**

PART- B

05. (a) What is Laplace transform? By definition, show that the Laplace transform of $\sin t$ is $\frac{1}{s^2+1}$. **03**

(b) If $\mathcal{L}(F(t)) = f(s)$, then show that $\mathcal{L}(t^n F(t)) = (-1)^n f^n(s)$ for $n = 1,2,3 \ldots$, and hence find the Laplace transform of $t^2 \cos at$. **5.67**

(c) Use Laplace transform to show that $\mathcal{L}\left\{\int_0^t \frac{1-e^{-u}}{u}\, du\right\} = \frac{1}{s}\ln\left(1+\frac{1}{s}\right)$. **03**

06. (a) What down some applications of Fourier transform. Transform the function $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ with the help of Fourier transform and hence use Parseval's identity of Fourier transform to prove $\int_{-\infty}^{\infty} \frac{sin^2 x}{x^2} dx = \pi$. **05**

(b) Use Fourier transform to solve one dimensional heat equation with diffusivity 1, i.e., $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, $0 < x < 1$ subject to initial condition $u(x,0) = 1$, $0 < x < 1$ and boundary condition $u(0,t) = 0$ and $u(1,t) = 0$ for $t > 0$. **6.67**

07. (a) Solve the following initial value problem using Laplace and inverse Laplace transform: **06**

$$Y'''(t) - 3Y''(t) + 3Y' - Y = t^2 e^t; \qquad Y(0) = 1, Y'(0) = 0, Y''(0) = -2.$$

(b) Solve the following simultaneous ordinary differential equations using Laplace and inverse Laplace transform: **5.67**

$$\frac{dX}{dt} = 2X - 3Y, \ \frac{dY}{dt} = Y - 2X \text{ subject to } X(0) = 8, Y(0) = 3.$$

08. (a) Define following terms and give examples for each: **06**

(i) Odd function, (ii) Periodic function, and (iii) exponential order.

(b) What is Fourier series of a function? Expand $f(x) = \sin x$ in Fourier cosine series in $0 < x < \pi$, where period is π. **5.67**

Department of Information and communication Engineering
Pabna University of Science and Technology

Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Final Examination-2021

Session: 2019-2020, 2018-2019, 2017-2018, 2016-2017

Course Code: Stat-2201 **Course Title:** Sampling Distribution and Hypothesis Testing

NB:
1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.

Time: 3 Hours **Full Marks: 70**

PART-A

1. a) What is sampling distribution? Explain with an example. Mention some uses of t distribution. $3\frac{2}{3}$
   b) Define F distribution. Find the mean and variance of F distribution. 04
   c) Show that the mode of the F-distribution is with $n_1(\geq 2)$ and n_2 df is $\frac{n_2(n_1-2)}{n_1(n_2+2)}$. 04

2. a) Define chi-square (χ^2) variate. Write the probability density function of χ^2 variate. 02
   b) Derive the moment generating function of chi-square distribution. Hence or otherwise find mean variance, skewness and kurtosis of this distribution. 06
   c) Show that for large sample size the chi-square distribution tends to normal distribution. $3\frac{2}{3}$

3. a) What is statistical inference? Distinguish between estimation and hypothesis testing. $3\frac{2}{3}$
   b) Define estimator. What are the desirable properties of a good estimator? Briefly discuss them. 04
   c) If X_1, X_2 *and* X_3 is a random sample of size 3 from a population with mean value μ and variance σ^2. T_1, T_2 and T_3 are the estimators used to estimate mean value μ, where 04

$$T_1 = X_1 + X_2 - X_3,\ T_2 = 2X_1 + 3X_3 - 4X_2 \text{ and } T_3 = \frac{1}{3}(\lambda X_1 + X_2 + X_3)$$

   (i) Are T_1 and T_2 unbiased estimators?
   (ii) Find the value λ such that T_3 is unbiased estimator for μ.
   (iii) With this value of λ is T_3 a consistent estimator?
   (iv) Which is the best estimator among T_1, T_2 and T_3?

4. a) Define variate transformation. Explain Square-root transformation and Fisher's-z transformation. Find the value of Jacobian from the following transformations. $6\frac{2}{3}$

$$y_1 = x_1 + 2x_2 + 3x$$
$$y_2 = 2x_1 - x_2$$
$$y_3 = x_2 + x_3$$

   b) Suppose $f(x) = \frac{2}{35}(x+3);\ -2 \leq x \leq 3$. Determine the distribution of $Y = 2x + 3$. 05

PART-B

5. a) Define: (i) Null hypothesis, (ii) Composite hypothesis, (iii) P-value, (iv) Critical region and (v) Power of the test. 05

   b) When should a one tailed test be used? A two tailed test? 02

   c) What are the different kinds of error made in hypothesis testing? Which kind of error is more serious and why? $4\frac{2}{3}$

6. a) Distinguish between t-test and z-test. 03

   b) The average farm size in the United States is 444 acres. A random sample of 40 farms in Oregon indicated a mean size of 430 acres, and the population standard deviation is 52 acres. At $\alpha = 0.05$, can it be concluded that the average farm in Oregon differs from the national mean? Use the P-value method. 04

   c) The following data represent the blood sugar of a group of patients before (B) and after (A) of a specific treatment. Is the treatment successful? $4\frac{2}{3}$

   Blood sugar (A) : 142, 146, 156, 120, 138, 160, 150, 155, 180, 210
   Blood sugar (B) : 120, 130, 120, 115, 100, 160, 150, 138, 160, 180

7. a) Suppose that X is a normal variate with mean μ and variance σ^2. Derive the test procedure for testing the following hypothesis: 06

   (i) $H_0: \mu_1 = \mu_2$ against $H_1: \mu_1 \neq \mu_2$
   (ii) $H_0: {\sigma_1}^2 = {\sigma_2}^2$ against $H_1: {\sigma_1}^2 \neq {\sigma_2}^2$

   b) Under what situations do you conduct proportion test? In an industry 100 workers are working, 25 of them are skilled. In another industry there are 18 skilled workers out of 125 workers. At $\alpha = 0.01$, are the skilled workers similar in both industries? Find the 99% confidence interval for the difference of the two proportions. $5\frac{2}{3}$

8. a) Illustrate the Bayesian method of interval estimation. Derive $100(1-\alpha)\%$ confidence interval for θ from the given density function $f(x,\theta) = \theta e^{-\theta x}$; $x \geq 0, \theta > 0$ and $\pi(\theta) = e^{-\theta}$. 05

   b) What is contingency table? Describe how would you test independence of attributes in $r \times c$ contingency table? What do you mean by the term "degree of freedom" associated with the χ^2 test statistic in testing the independence of attributes in $r \times c$ contingency are $(r-1)(c-1)$. $6\frac{2}{3}$