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. $3\frac{2}{3}$

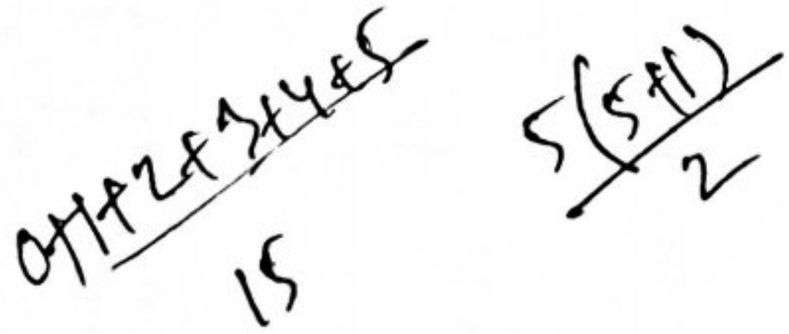
b) Explain the concept of backtracking with the help of suitable example. 3

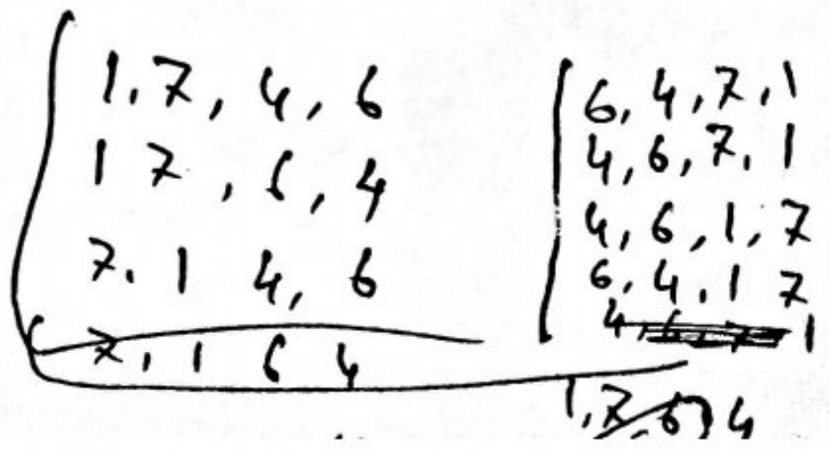
c) Solve 8-queen's problem for a feasible sequence (8, 2, 5, 3). 5

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

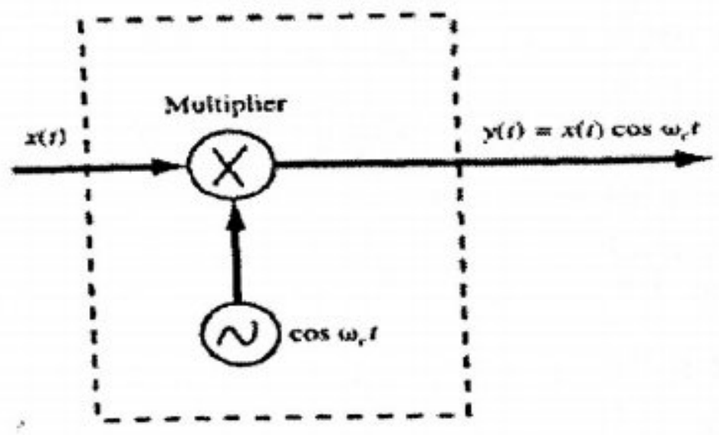


Fig-2.b

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

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

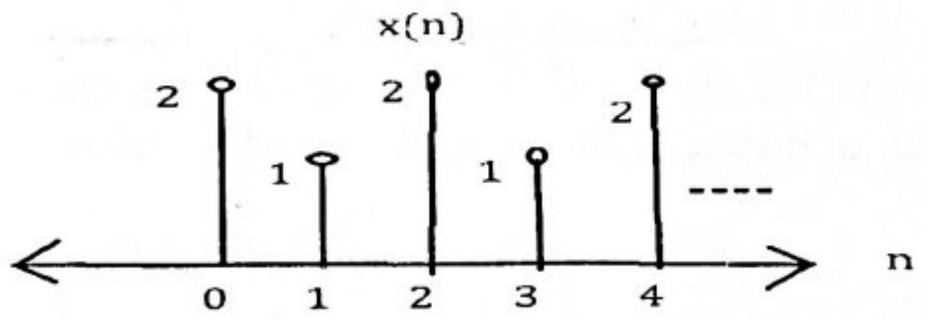
$$X(t) = 1 + sin2\omega_0 t + 2cos2\omega_0 t + cos\,(3\omega_0 t + \frac{\pi}{3}).$$

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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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 $\overrightarrow{H}$. 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

Department of Information and Communication Engineering
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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: $6\frac{2}{3}$
   $\frac{d^2y}{dt^2} - \frac{dy}{dt} - 2y = t^2;\ y(0) = 1,\ y'(0) = 3.$

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
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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: **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 $f\left(\frac{x}{\theta}\right) = \frac{1}{\theta}e^{-\frac{x}{\theta}}$, $4\frac{2}{3}$
   $x > 0$. 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. 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 $5\frac{2}{3}$
   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.

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. 6

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.

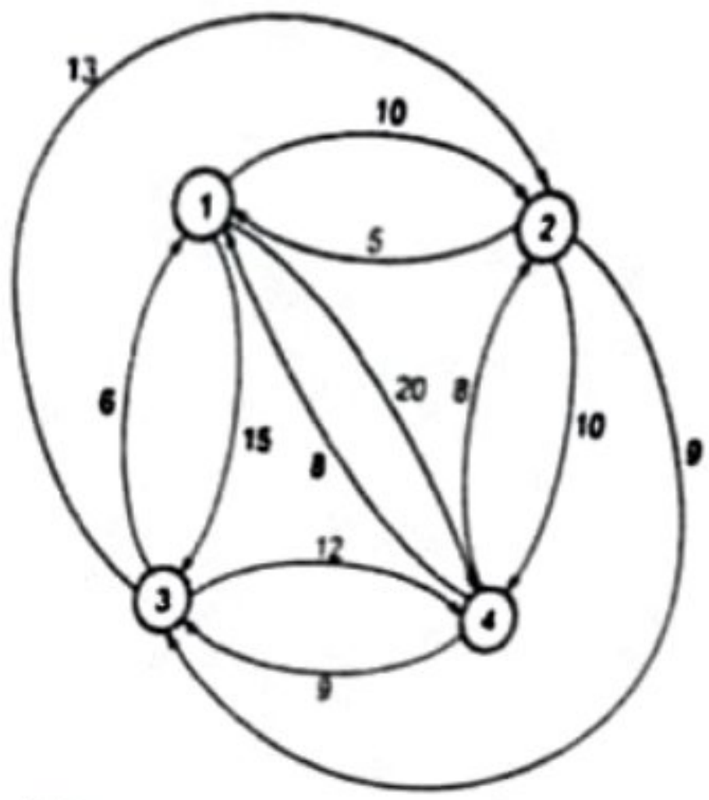
b) What is a recursive algorithm? Write an algorithm for tower of Hanoi puzzle to move n disk from tower x to tower y.

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.

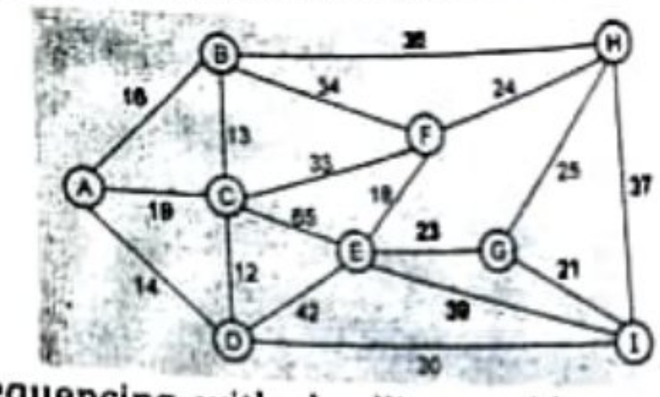
c) What do you understand by graph coloring? Describe backtracking algorithm to find all Hamiltonian cycles in a graph.

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.

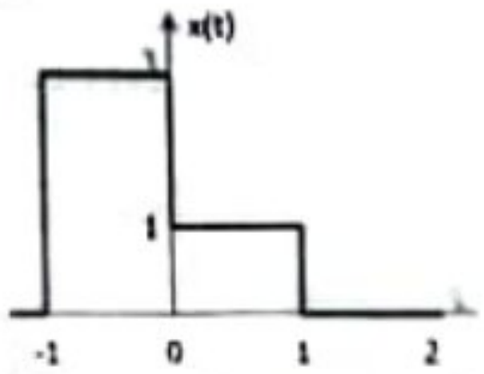
Time: 3 Hours **Total Marks: 70**

PART-A

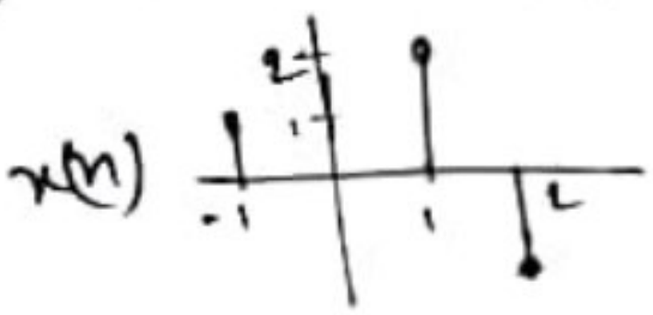
1. a) Define signal. Explain advantages of digital signal processing over analog signal processing. $2\frac{2}{3}$

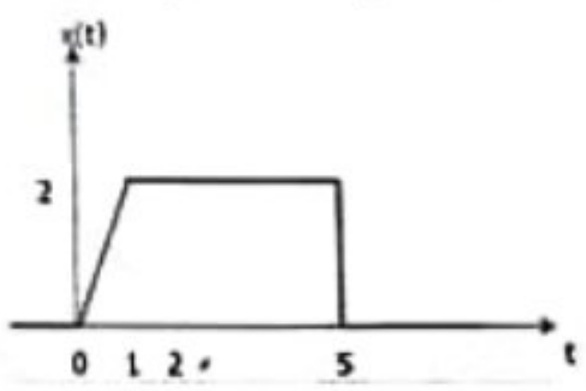
b) Explain the following terms: (i) Continuous-time and Discrete-time Signals and (ii) Deterministic and Random Signals. 3

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 $1500\mu V/m$. 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
   $$D = 2h\sqrt{\left\{\left(\frac{f}{f_c}\right)^2 - 1\right\}}$$ 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; 3
   i) Light incident on a glass whose index of refraction is 1.6
   ii) Radio frequency wave incident on water (n=8). $5\frac{2}{3}$
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 $0.01\mu F/Km$ 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. 2
   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? 3
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. 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

Department of Information and Communication Engineering
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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**

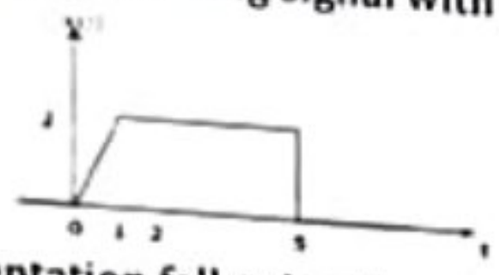
NB:
1. Answer any **SIX** (**THREE** from each **PART**) questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

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?
   b) Express the given signal sequences as a time-shifted impulse. 1.67

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

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

   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 $h(t) = u(t+1) - 2u(t-1) + u(t-3)$. 6
   Find the convolution integral of the sequences.
   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 $x_1(n) = \{1, 2, -3, 4, -5\}$; 2.67
   $x_2(n) = \{-2, 4, 6\}$ using matrix method.

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. $3\frac{2}{3}$
Establish the connection between real and complex line integrals. 4

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

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

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 $1 \pm i, -1 \pm i$. $6\frac{2}{3}$

4. a) Applying calculus of residues prove that 5
$$\int_{-\infty}^{\infty} \frac{dx}{(1+x^2)^2} = \frac{\pi}{4}$$

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).

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.

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

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 $f(x)=0<x<4$ and hence show that $\frac{\pi^2}{8}=1+\frac{1}{3^2}+\frac{1}{5^2}+\cdots\cdots\cdots\cdots\cdots$ 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. 4

b) State and explain Sign test mentioning all possible assumptions, hypotheses and test statistic. $3\frac{2}{3}$

c) The appearance transit times for 11 patients with significantly dengue virus are as follows:

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 $\alpha = 0.005$.

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

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

$= \frac{1}{6}(1798 - 1856.41$

6.95

$\bar{x}_2 = \frac{183}{11}$

$= 14.878$

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

$= 15.369$

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

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. $4\frac{2}{3}$
   c) What is Amplitude modulation? Draw a comparison between AM and FM. 4

3. a) Explain pre-emphasis and de-emphasis with necessary circuit diagram. 3
   b) Define noise and SNR. How the SNR can be used to improve radio signaling? $4\frac{2}{3}$
   c) Draw and explain the block diagram of an AM Transmitter. 5

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

PART-B

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

6. a) What is AFC? Mention the spurious responses in radio receivers. 7
   b) Discuss the communication, code and radar receivers. 4

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? $3\frac{2}{3}$
   b) Justify the choice 625 lines of TV transmission. 4
   c) Discuss briefly monochrome picture tube with figure. 3

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

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? 1

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

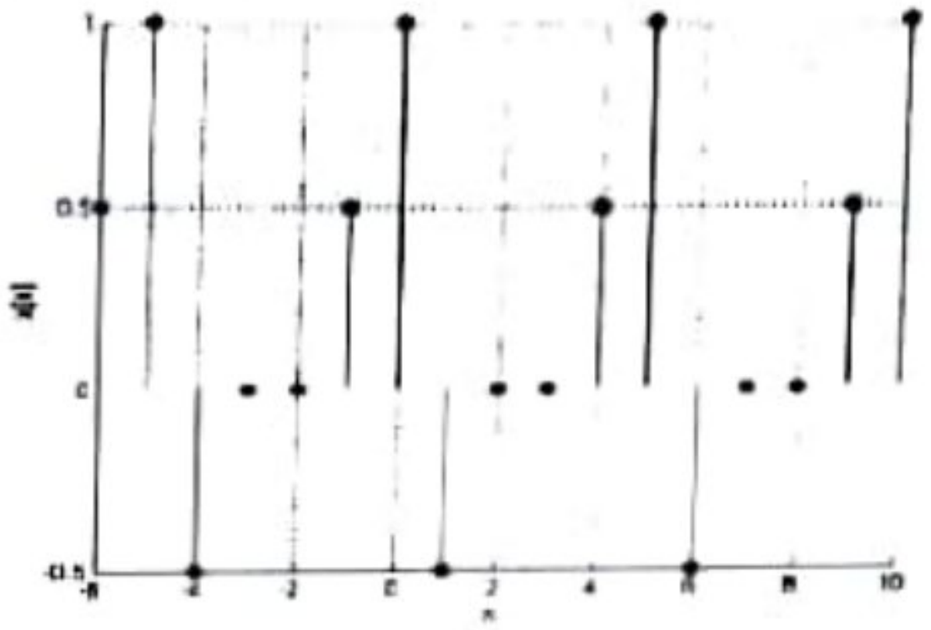
7. a) What is scanning and interlace scanning? 3.67
   b) How do you calculate the number of scanning line? 2
   c) What is composite video signal? 2
   d) Explain the vestigial sideband transmission with diagram. 4

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 :
   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. 5

   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?

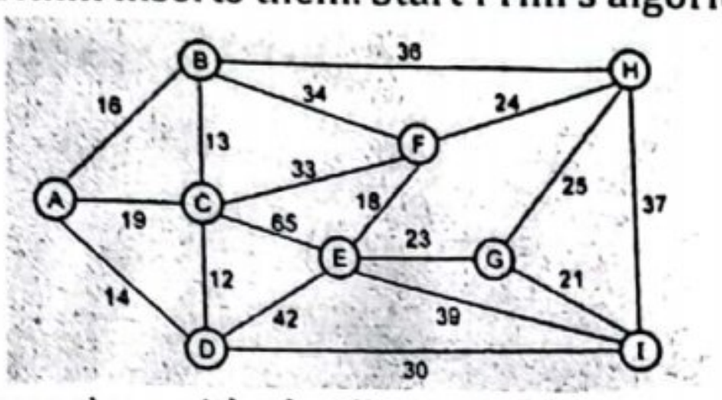
4. a) Write the insertion sort algorithm. Apply this insertion sort algorithm to sort the following numbers: 99, 77, 33, 44, 11, 88, 22, 66, 55 $5\frac{2}{3}$
   b) Consider the following 4-digit employee numbers 6
   9614, 5882, 6713, 4409, 7148
   Find the 2-digit hash address of each number using
   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? 3
   Given N=400 electron/cc for D region.

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**

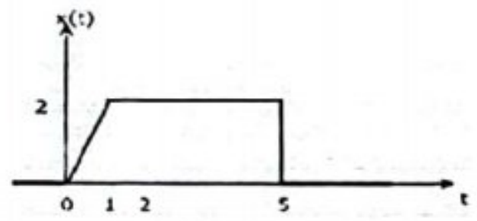
NB:
1. Answer any **SIX (THREE** from each **PART)** questions.
2. Figures in the right margin indicate marks.
3. Parts of the same question should be answered together and in the same sequence.
4. Separate answer script must be used for answering the question of **PART-A** and **PART-B**.

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 2
   $y[n] = \frac{1}{3}(x[n] + x[n-1] + x[n-2])$.
   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 $h(t) = u(t+1) - 2u(t-1) + u(t-3)$. 6
   Find the convolution integral of the sequences.
   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 $x_1(n) = \{1, 2, -3, 4, -5\}$; 2.67
   $x_2(n) = \{-2, 4, 6\}$ using matrix method.

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. 3, 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 $\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots \cdots$ $4\frac{2}{3}$

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 $\boldsymbol{Q}$ be an empty queue and $\boldsymbol{S}$ 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 $\boldsymbol{S}$ and $\boldsymbol{Q}$ 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

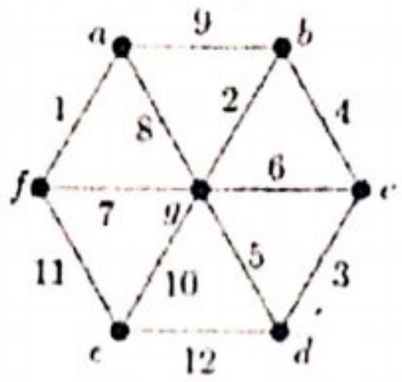
   b) Construct a 3-way search tree for the list of keys in the order shown below. 4
   What are your observations?
   List A: 10, 15, 20, 25, 30, 35, 40, 45
   List B: 20, 35, 40, 10, 15, 25, 30, 45

   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

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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.

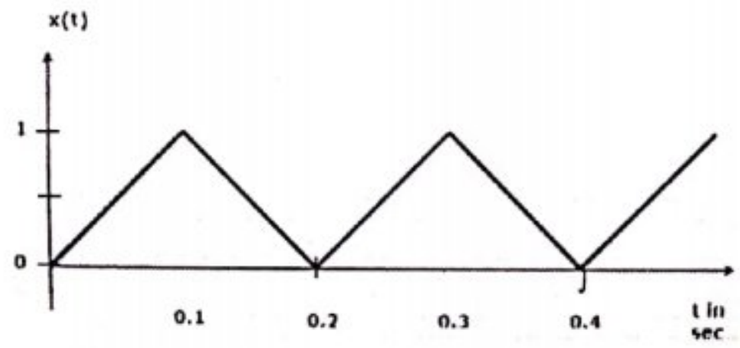
Time: 3 Hours (For Part A and Part B) **Total Marks: 70**

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

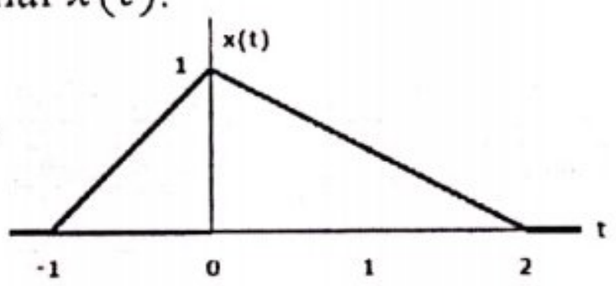
   ii) $x[n] = \sin(\frac{2\pi}{3})n$

   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 $x(n) = \{\ldots \underset{}{0.5} \quad 1 \quad -0.5 \quad 0 \quad 0 \quad 0.5 \quad \underset{\uparrow}{1} \quad -0.5 \quad 0 \quad 0 \quad 0.5 \quad 1 \quad -0.5 \ldots\}$. Find the DTFS of the signal $x(n)$.		$6\frac{2}{3}$
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 $x(n) = \left(\frac{1}{3}\right)^n u(n)$, ii) $h(n) = \alpha^n u(n), \lvert\alpha\rvert < 1$, and $x(n) = \beta^n u(n), \lvert\beta\rvert < 1$ using convolution property of DTFT.		$6\frac{2}{3}$
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 cm^2. 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

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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, $f(x,\theta) = \theta e^{-\theta x}$, $0<x<\infty$. 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, σ^2), 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

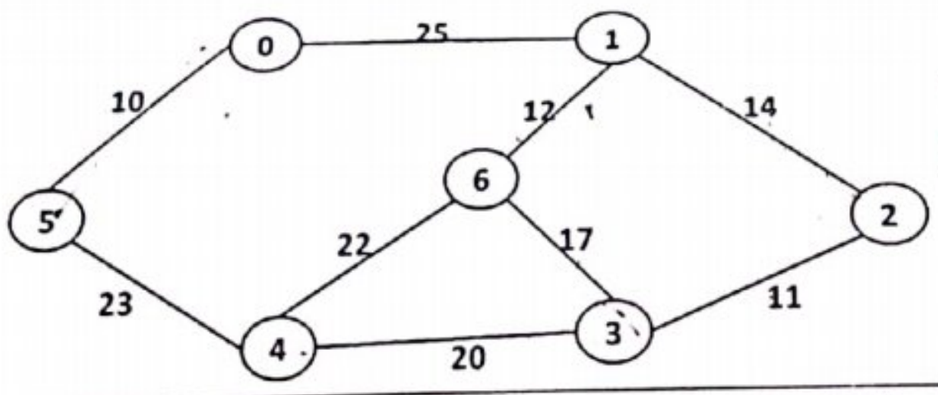
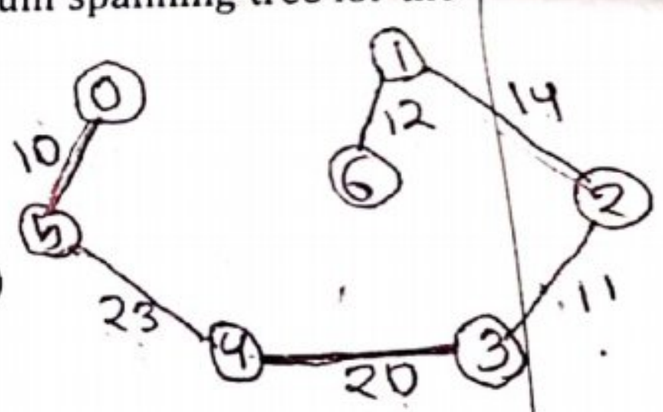
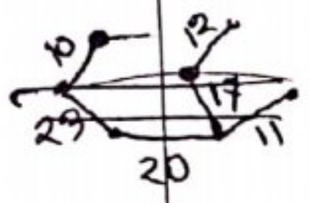
Pabna University of Science and Technology

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 $x_1(n) = 2x(n-5) - 3x(n+4)$.

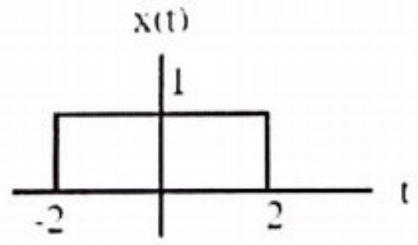
Q3. Write a Matlab/Python Code to perform the following operations: i) Sampling, ii) Quantization, and iii) Coding.

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
Faculty of Engineering and Technology
B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2022
Session: 2020-2021, 2019-2020

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) Differentiate between data type and data structure. Why should you have good knowledge on data structures as an ICE student? 4
   b) How does a point array can save memory when stores a variable sized group of data? Discuss with necessary figures. 3
   c) An array ICE[-4.....6, -2.....12], stores elements in Row Major Wise, with the address ICE[2][3] as 4142. If each element requires 2 bytes of storage, find the Base address. $4\frac{2}{3}$

2. a) Define AVL search tree. Explain LL rotation and RR rotation for the balancing of an AVL search with example. 5
   b) What is m-way search tree? Insert the following keys in the order shown below into an initially empty m-way search tree of order 4. $6\frac{2}{3}$

   G S F L Q X Z V R A I J W

3. a) Explain the linked representation of the graph. $6\frac{2}{3}$
   b) Write down the algorithm for topological sorting. Explain it with a graph. 5

4. a) Explain different pass of selection sort algorithm using some data items. Find the complexity of selection sort algorithm. $6\frac{2}{3}$
   b) Consider the following 4-digit employee numbers 5

   9814, 7887, 4793, 5509, 7249.

   Find the 2-digit hash address of each number using
   I) the division method with $m = 97$;
   II) the midsquare method.

PART-B

5. a) Define an algorithm. Explain the features of an efficient algorithm. 3
   b) Explain briefly Big oh, Big omega and Big Theta notation. $3\frac{2}{3}$
   c) Derive the recurrence relation for Fibonacci series algorithm and carry out the time complexity analysis. 5

6. a) State the general principle of Brute Force and Divide and Conquer approach. 2
   b) How many comparisons will be made by the brute force string matching algorithm in searching for each of the following patterns in the binary text of 1000 zeros? I) 00001 II) 10000. 4
   c) Write down the algorithm to construct a convex hull based on divide and conquer strategy. $5\frac{2}{3}$

7. a) Algorithms A and B spend exactly $T_A(n) = C_A n log_2 n$ and $T_B(n) = C_B n log_2 n$ microseconds respectively, for a problem size n. Find the best algorithm for processing $n = 2^{20}$ data items if the algorithm A spends 10 microseconds to process 1024 items and the algorithm B spends only 1 microsecond to process 1024 items. 3

b) What do you mean by dynamic programming? Given two sequences of characters, find out the length along with procedure of the longest common subsequence of both sequences BDCAB and ABCBD. $3\frac{2}{3}$

c) Draw a state transition diagram for the string matching automation that accepts all strings ending in the string "acabaca". 5

8. a) Devise an algorithm to make for 1655 using the greedy strategy. The coins available are {1000, 500, 100, 50, 20, 10, 5}. 4

b) What is N-Queen's problem? Draw the state space tree for 4-queen's problem. 4

c) Consider a set $S = \{5, 10, 12, 13, 15, 18\}$ and $sum = 30$. Use the backtracking model to arrive at the solution of this sum of subset problem. $3\frac{2}{3}$

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-2022

Session: **2020-2021, 2019-2020, and 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.

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

PART-A

1. a) Define Modulation. Calculate the minimum length of antenna required to transmit a radio signal of frequency 20 MHz? 4
   b) Provide the standard classification spectrum of frequency used in radio communication. $4\frac{2}{3}$
   c) Describe the basic constituents of Communication system. 3

2. a) The noise output of a resistor is amplified by a noiseless amplifier having gain of 30 and bandwidth of 35 KHz. A meter connected to output of the amplifier reads 4 mV r.m.s. (a) If the resistor is operated at 27^0c, what is its resistance? (b) If the bandwidth of the amplifier is reduced to 10 KHz, its gain remaining constant, what will the meter read now? 4
   b) Define Noise temperature. Find out the equivalent noise temperature T_{eq} for the noise figure F. $4\frac{2}{3}$
   c) Describe the sources of extra-terrestrial noise. 3

3. a) A broadcast transmitter radiates 4.72 kW when the modulation percentage is 60. Calculate the total power when the modulation has been reduced to 40 percent. 2
   b) Write expression for the sinusoidal carrier voltage which has been phase modulated by another sinusoidal modulating voltage. 5
   c) Define modulation index. Compare between Frequency Modulation and Amplitude Modulation $4\frac{2}{3}$

4. a) Analyze the frequency spectrum and power relations in single sideband modulation technique. 4
   b) Explain the generation of DSBSC signal using diodes. 4
   c) A VSB transmitter that transmits 25% of the other sideband along with wanted sideband, radiates 0.625 kW when the modulation percentage is 60%. How much of carrier power (in kW) is required if we want to transmit the same message by an AM transmitter? $3\frac{2}{3}$

PART-B

5. a) Briefly describe the salient features of broadcast receivers. 3
   b) Classify receiving aerials. Draw and describe the block diagram of a super heterodyne receiver. $5\frac{2}{3}$
   c) Sketch the circuit of a simple Noise Limiter and briefly describe its working principle. 3

6. a) What is the function of F.M. Detectors? Briefly explain the mechanism of F.M. Detectors. 3

b) Draw and explain the simplified block diagram of a monochrome television broadcasting system. 5

c) Explain the working principle of slope detector circuit. $3\frac{2}{3}$

7. a) 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

b) Explain the basic principle of operation of a television camera tube. 3

c) Define flicker. Calculate the number of scanning lines in TV transmission. $4\frac{2}{3}$

8. a) Why pilot carrier transmitter is used as a variant of SSB transmitter, explain with block diagram. 5

b) What are the factors that influence the choice of intermediate frequency? 4

c) Define sensitivity, selectivity and image frequency rejection. $2\frac{2}{3}$

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-2022

Session: 2020-2021, 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.

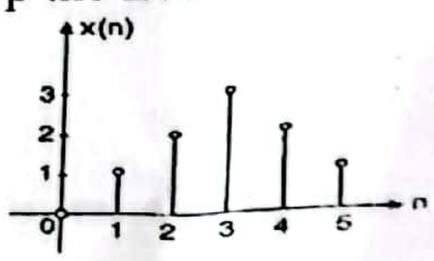
Time: 3 Hours **Total Marks: 70**

PART-A

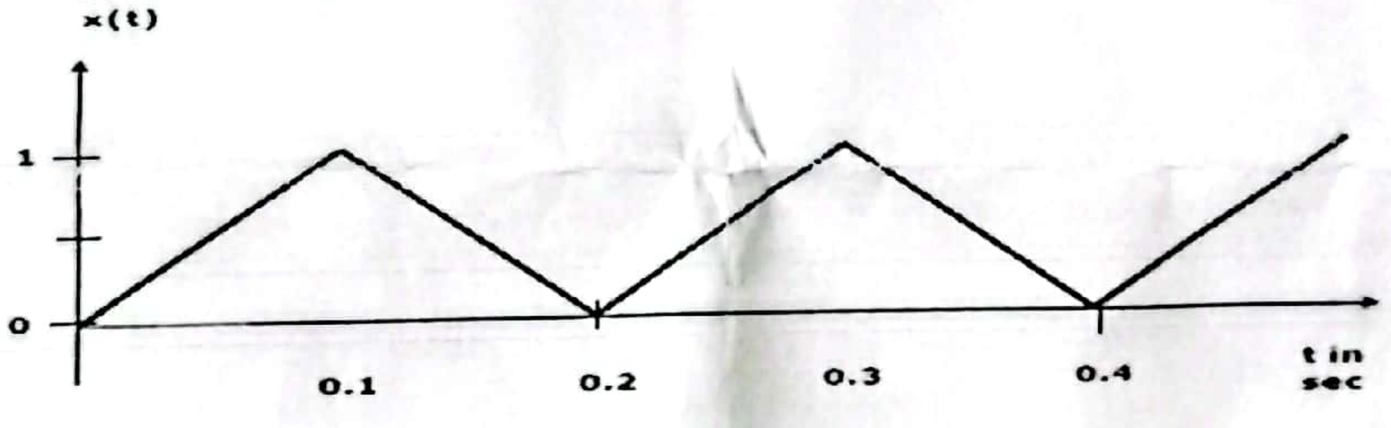
1. a) What do you understand by signals and systems? Classify them. $2\frac{2}{3}$

b) Define one dimensional and multi-dimensional signals with examples. 2

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



d) Determine whether the following signals are energy or power signals. Also determine average power and energy of the signals. 3



2. a) Define non-periodic signal. Classify each of the following as periodic or non-periodic. If periodic, find the fundamental period of that signal. 3

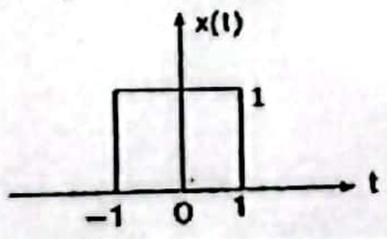
i) $x[n] = sin\left(\frac{2\pi}{3}\right)n$

ii) $x(t) = \cos\left(\frac{\pi}{3}\right)t + \sin\left(\frac{\pi}{5}\right)t$

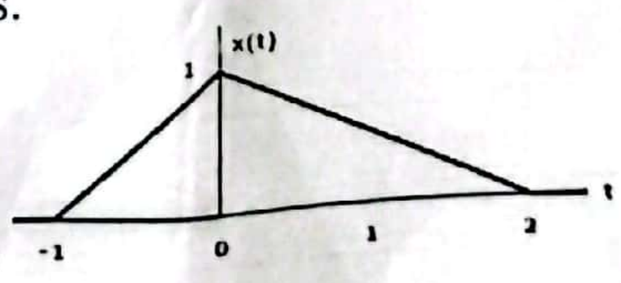
b) Explain the operations performed on independent variable(s) of a signal. $3\frac{2}{3}$

c) Find $x(2t + 3)$ for the given signals. 5

i)

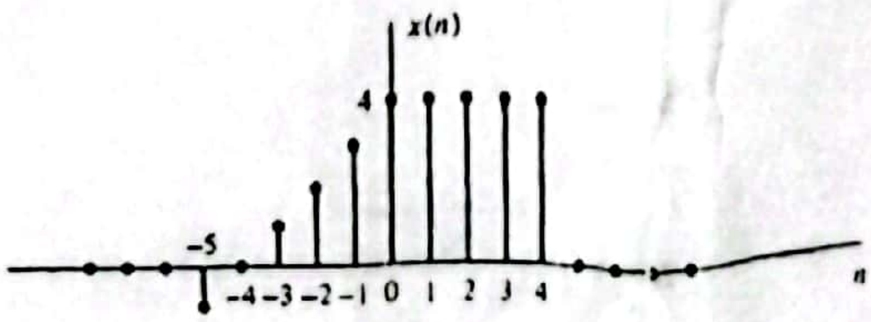


ii)

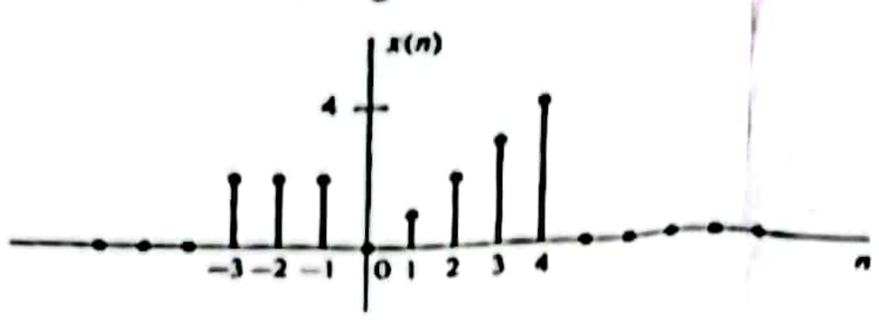


3. a) Define quantization error and dynamic range of a signal. 2

b) A signal x (n) is graphically illustrated in below. Show a graphical representation of the signals $x(n - 3)$ and $x(n + 2)$. 4



c) Show the graphical representation of the signals $x(-n)$ and $x(-n+2)$, where $x(n)$ is the signal illustrated in below figure. 4



d) Using basic building blocks, sketch the block diagram representation of the discrete-time system described by the input-output relation- $y(n) = 4y(n-1) + 3x(n) + 5x(n-1)$. $1\frac{2}{3}$

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 $h(n) = \begin{cases} 1, & n = \pm 1 \\ 2, & n = 0 \\ 0, & \text{Otherwise} \end{cases}$ and $x(n) = \begin{cases} 2, & n = 0 \\ 3, & n = 1 \\ -2, & n = 2 \\ 0, & \text{Otherwise} \end{cases}$. 5

b) 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. $2\frac{2}{3}$

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

PART-B

5. a) Consider the special case of a finite-duration sequence given as 2
$x(n) = \{2, 4, \underset{\uparrow}{0}, 3\}$

Resolve the sequence x (n) into a sum of weighted impulse sequences.

b) Summarize the process of computing the convolution between $x(k)$ and $h(k)$. 4

c) The impulse response of a linear time-invariant system is $5\frac{2}{3}$
$h(n) = \{1, 2, \underset{\uparrow}{1}, -1\}$

Determine the response of the system to the input signal
$x(n) = \{1, 2, \underset{\uparrow}{3}, 1\}$.

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) Explain the following properties of DTFT: i) Frequency shifting, ii) Time reversal, and (iii) Convolution properties. $6\frac{2}{3}$

b) Find the convolution of the sequences $h(n) = \alpha^n u(n), |\alpha| < 1$, and $x(n) = \beta^n u(n), |\beta| < 1$ using convolution property of DTFT. 3

c) State and prove Parseval's relation for discrete-time periodic signal. 2

8. a) Show that DFT is periodic with period N. 2

b) Deduce the DIT algorithm for 4-point sequence, i.e., $N = 4$. 4

c) Find 4-point DFT and IDFT for the given data sequence $x[n] = \{1, 2, 2, 1\}$. $5\frac{2}{3}$

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-2022

Session: **2020-2021 & 2019-2020**

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 are the physical significant of the Maxwell's equations?	2
	b)	Find out the expressions: i) $\bar{\nabla} \bullet \bar{D} = \rho$ and ii) $\bar{\nabla} \times \bar{H} = \sigma\bar{E} + \epsilon \frac{\partial \bar{E}}{\partial t}$ where the symbols have their usual meanings.	$5\frac{2}{3}$
	c)	Derive the equation of Lorentz's Lemma. What is the significance of it?	4
2.	a)	Using Maxwell's equations derive the wave equation for magnetic field in free space.	4
	b)	Obtain Poynting theorem for the conservation of energy in an electromagnetic field.	$4\frac{2}{3}$
	c)	Explain **E-H** symmetry with mathematical expression.	3
3.	a)	What is Uniform Plane wave? Show that for Uniform Plane wave $\frac{\bar{E}}{\bar{H}} = \sqrt{\frac{\mu}{\varepsilon}}$.	7
	b)	Derive the electromagnetic wave equation in a lossless medium.	$4\frac{2}{3}$
4.	a)	How does the electrical property of earth affect the surface wave propagation?	$2\frac{2}{3}$
	b)	Derive the expression for the refractive index of the ionosphere.	7
	c)	Define the term used in radio wave propagation: i) Super refraction and ii) Duct propagation.	2

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.	$6\frac{2}{3}$
	b)	With mathematical expression explain depth of penetration.	2
	c)	Define: i) Critical angle, ii) Brewster angles and iii) Total Internal reflection.	3
6.	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 $\alpha = \frac{R}{2}\sqrt{\left(\frac{C}{L}\right)} + \frac{G}{2}\sqrt{\left(\frac{L}{C}\right)}$.	$6\frac{2}{3}$
	b)	Define propagation constant. What are the values of SWR for open circuit, short circuit 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
7.	a)	Write the differences between Transmission line and Waveguide.	$2\frac{2}{3}$
	b)	Obtain the expression of: i) group velocity, ii) phase velocity and iii) cut-off frequency.	5
	c)	What should be the separation between the planes of a plane parallel guide so that a wave of 10 Gc/s may propagate in a mode having $m = 3$ and guided wavelength equal to 6.91 cm ?	4

8. a) What do you mean by cut-off wavelength of a waveguide? Show that for rectangular waveguide $\lambda_c = \frac{2}{\sqrt{\left(\frac{m}{a}\right)^2 + \left(\frac{n}{b}\right)^2}}$, where the symbols have their usual meanings. 8

b) A rectangular waveguide has dimensions of $1 \times 2\ cm^2$. Find the guided wavelength at a wavelength of $0.5\ cm$ for dominant mode. $3\frac{2}{3}$

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Faculty of Engineering and Technology

B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2022

Session: **2020-2021, 2019-2020 & 2018-2019**

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

1. a) Define modulus and argument of a complex number. Find all the values of $\left(-2-2\sqrt{-3}\right)^{\frac{1}{3}}$. 4

b) If z be a complex number, then describe geometrically the set of points z satisfying $1 \le |z-1+i| < 2$. $2\frac{2}{3}$

c) Find all the roots of the equation $\cosh z = i$. 2

d) Let z be a complex number. Prove that $\sqrt{2}|z| \ge |\mathrm{Re}(z)| + |\mathrm{Im}(z)|$. 3

2. a) Define single valued and multiple valued function with examples. 2

b) Define limit of a complex function. Prove that $\lim_{z \to i} f(z)$ exists and find its value where 5

$$f(z) = \begin{cases} \dfrac{z^2+4}{z-2i}; z \neq 2i \\ 3+4i; z = 2i \end{cases}$$

Is it continuous at $z = i$?

c) Prove that the function $f(z) = |z|^2$ is continuous everywhere but nowhere differentiable except at the origin. $4\frac{2}{3}$

3. a) Define analytic function at a point. State and prove the necessary conditions for a complex function to be analytic at any point. $4\frac{2}{3}$

b) Define harmonic function. Express $f(z) = u(x,y) + iv(x,y)$ as an analytic function of z if 4

$$u(x,y) = e^{2x}(x\cos 2y - y\sin 2y).$$

c) Describe the types of isolated singularities with examples. 3

4. a) Evaluate $\int_{(0,3)}^{(2,4)} (2y + x^2)dx + (3x - y)dy$ along $5\frac{2}{3}$

(i) the parabola $x = 2t,\ y = t^2 + 3$.

(ii) straight lines from $(0,3)$ to $(2,3)$ and then from $(2,3)$ to $(2,4)$.

b) State Cauchy's residue theorem. Evaluate the following integral using Cauchy's residue theorem $\oint \frac{z^2-2z}{(z+1)^2(z^2+4)} dz$, where the contour region is $|z| = 3$. 6

PART-B

5 a) Define Laplace transform. Discuss the advantages of Laplace transform. 4

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

c) Evaluate the followings: $(i)\ \mathcal{L}\{e^{-t}sin^2 t\}$. $(ii)\ \mathcal{L}\{t^2 e^{-2t}\ cost\}$. 4

6 a) Define error function. Using Laplace transform, prove that $\int_0^\infty \cos x^2 dx = \frac{1}{2}\sqrt{\frac{\pi}{2}}$. $7\frac{2}{3}$

4

b) Evaluate $\mathcal{L}^{-1}\left\{\frac{2s^2-4}{(s+1)(s-2)(s-3)}\right\}$.

7. a) Use the Laplace transform to solve the differential equation $x'' - 4x' + 4x = 4\cos 2t$, where $x(0) = 2$ and $x'(0) = 5$. $5\frac{2}{3}$

b) Solve the boundary value problem using the Laplace transform: $\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$, where $U(x,0) = 3\sin 2\pi x, U(0,t) = 0, U(1,t) = 0$ and $0 < x < 1, t > 0$. 6

8. a) Define Fourier sine and Fourier cosine series. Obtain the Fourier series of the function 7

$$f(x) = \begin{cases} 0; -\pi \le x \le 0 \\ 1; 0 \le x \le \pi \end{cases}$$

b) Find the finite Fourier sine and cosine transform of the function $F(x) = 2x$, where $0 < x < 4$. $4\frac{2}{3}$

Department of Information and Communication Engineering

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B.Sc. (Engineering) 2nd Year 2nd Semester Examination-2022

Session: 2020-2021, 2019-2020, 2018-2019, 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 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)	What do you understand by point estimation? How does it differ from interval estimation?	**04**
	b)	Define with example estimator and parameter. Describe the criteria of a good estimator.	**03**
	c)	Define mean square error (MSE) consistency and simple consistency. Show that if $X \sim N(\mu, \sigma^2)$, then sample mean is satisfied both of consistency.	**4.67**
02.	a)	Define maximum likelihood function. How does it differ to joint density function?	**5**
	b)	Find MLE: i) $f(x,\theta) = \frac{1}{\theta}e^{-\frac{x}{\theta}}$, 0<x<0 ii) $f(x;\theta) = \theta^x(1-\theta)^{1-x}$; $x = 0, 1$. Check whether likelihood estimator is unbiased and consistent estimator of 0.	**6.67**
03.	a)	Define chi-square distribution. Find the cumulant generating function of chi-square distribution.	**03**
	b)	Write down the applications of chi-square distribution.	**03**
	c)	If x^2 is a chi-square variate which with $n\,d.f$ then prove that for large n, $\sqrt{2x^2} \sim N(\sqrt{2n}, 1)$.	**5.67**
04.	a)	Define student's t statistics. Write down some applications of student's t distribution.	**03**
	b)	If X has normal distribution $N(\mu, \sigma^2)$, then for sample size n, the random variable $t = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}$ has distribution $T(n-1)$.	**04**
	c)	Define F-distribution. If you draw two independent samples of size n_1 *and* n_2 respectively from two normal population with the same variance then show that $\frac{S_1^2}{S_2^2} \sim F(n_1 - 1, n_2 - 1)$.	**4.67**

PART B

05. a) What do you mean by Z-test? Mention the applications of it. **03**

b) What is statistical error? Describe in brief. **03**

c) The following dataset represents the growth of tumor cell in rats (measured in mm) before and after specific meditation. **5.67**

Before treatment (B)	:	144	148	154	118	140	152	156	182	210	175
After treatment (B)	:	125	135	112	100	155	165	130	162	186	145

Is treatment effect significantly differ?

06. a) What is P-value? How to make decision in a test based on P-value and level of significance? **03**

b) Describe steps of mean test when variance unknown and sample size is small ($n < 30$). **4.67**

c) Test the following hypothesis, $H_o: \mu = 25, H_1: \mu > 25$, given $\bar{x} = 27.2, n = 12, \sigma = 4.0$ *and* $\alpha = 0.03$. **04**

07. a) What is test of hypothesis concerning two population means? Discuss different situations to perform these tests and their test statistic. **04**

1.64

b) An official of LGRD Department of Highway wants to compare the useful life, in months, of two brands of paint used for striping roads. The mean number of months Berger paints lasted was 36.2, with standard deviation of 1.14 months. The official reviewed 35 road stripes. For Elite paint, the mean number of months was 37, with standard deviation of 1.3 months. The official reviewed 40 road stripes. At the 0.01 significance level, is there a different in the useful life of the two paints? Compute the p-value. Comment based on p-value. **4.67**

c) What is pared t-test? State two situations when this test is applicable. **03**

08. a) What is test of hypothesis concerning attributes? Discuss test procedure of a hypothesis about proportion test of a population. **3.67**

b) A survey number of consumers regarding the quality of product in rural and urban areas produces the following results **04**

Opinion	Rural	Urban
Highly Satisfactory	40	150
Satisfactory	55	130
Not Satisfactory	125	90

At the 5% level of significance, to investigate whether the opinion is independent of the area.

c) Carry out the test of proportions at 5% level of significance **04**

i) $H_o: P = 0.70, H_1: P \neq 0.70, n = 300, x = 220$

ii) $H_o: P = 0.45, H_1: P > 0.45, n = 250, x = 150$