1. (a) Find the Fourier series of periodicity 2 for
\[ f(x) = \begin{cases} x & \text{in } -1 < x < 0 \\ x+2 & \text{in } 0 < x < 1 \end{cases} \]
(b) Obtain the half-range sine series in the interval 0 < x < \pi for
the function f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}.

2. (a) Find the Fourier cosine transform of e^{-ax^2}.
(b) An infinitely long string having one end at x = 0, is initially at rest along the x-axis. The end \( x = 0 \) is given a transverse displacement \( f(0) \), \( t > 0 \). Find the displacement of any point of the string at any time.

3. (a) If \( \cosh x = \sec \theta \), prove that \( x = \log \left( \frac{\pi}{4} \right) \) and \( \frac{\pi}{4} \).
4. (a) An electromagnetic field in the $xy$-plane is given by the potential function $\phi = 3x^2 - y^2$. Find the stream function.

(b) Find the bilinear transformation which maps the points $w = 1, i, -1$ into the points $z = 2, i, -2$ respectively. Find the fixed and critical points of the transformation.

5. (a) A man known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.

(b) The frequency function of a continuous random variable is given by $f(x) = 3x(2-x)$, $0 \leq x \leq 2$. Find the value of $\gamma_1$ and variance of $x$.

- Find the probability that a bomb dropped from a plane will strike the target.
- Exactly two will strike the target.
- At least two will strike the target.

6. The probability that a bomb dropped from a plane will strike the target.

(a) more than 60 marks?
(b) less than 56 marks?
(c) between 45 and 65 marks?
7. (a) Define:
(i) Feasible solution
(ii) Basic solution
(iii) Basic feasible solution
(iv) Non-degenerate BFS
(v) Degenerate BFS
(vi) Optimum Basic feasible solution
(vii) Unbounded solution.

(b) Using graphical method, solve the LPP
Maximize \( z = 7x + 3y \)
subject to
\[
\begin{align*}
  x + 2y & \geq 3, \\
  x + y & \leq 4, \\
  0 \leq x \leq 5/2, \\
  0 \leq y \leq 3/2 
\end{align*}
\]

8. Solve the following problem using simplex method.
Maximize \( Z = 7x + y + 2z \)
subject to
\[
\begin{align*}
  x + y - 2z & \leq 10, \\
  4x + y + z & \leq 20, \\
  x, y, z & \geq 0 
\end{align*}
\]