Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (ECE)/SEM-1/MC-101/2010-11

2010-11

ADVANCE ENGINEERING MATHEMATICS FOR COMMUNICATIONS

Time Allotted : 3 Hours | Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Short Answer Type Questions)

1. Answer all the following : 5 × 2 = 10

a) Write the advantages and disadvantages of Graeffe's root squaring method to solve an algebraic equation.

b) Write the limitations of an L.P.P.

c) Define pure birth model in Queuing theory.

d) Define even and odd functions and given its implication on Fourier series. For what kind of signal Fourier series can not be applied to find the spectrum ?

e) Prove that for a complex variable $z = x + jy$, $z^{-1} = \frac{\bar{z}}{|z|^2}$.

GROUP – B

(Long Answer Type Questions)

Answer any *four* of the following. 4 × 15 = 60

2. a) Derive the condition of convergence of Newton-Raphson method to approximate a root algebraic or transcendental equations. 4

   b) Write the geometrical interpretation of Newton-Raphson method. 4

   c) By Graeffe's method, compute the roots of the equation $x^3 - 13x^2 + 47x - 35 = 0$, correct up to four decimal places. 7

3. Arrival at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with mean 3 minutes.

   i) What is the probability that a person arriving at the booth will have to wait ?

   ii) Find the average no. of units of the system.

   iii) Find the probability that a customer will have to wait more than 10 minutes before the phone is free.

   iv) Find the probability that there are more than 5 customers waiting for call. 15

4. a) Find by Lagrange's formula the polynomial of degree three in x by using the following data and compute $f(2{\cdot}3)$.

x :	0	1	2	3
$f(x)$:	1	2	11	34

7

b) Solve graphically the following L.P.P. :

$x_1 + x_2 \le 6,\ 6x_1 + 3x_3 \ge 12,\ 2x_1 + 3x_2 \ge 6,\ x_1, x_2 \ge 0$ 6

c) Write the limitations of Graphical solution of linear programming problem. 2

5. a) Define a complex analytic signal $f(z)$, where $z = x + jy$. If $u(x, y)$ and $v(x, y)$ are real-valued functions, such that $f(z) = u(x, y) + jv(x, y)$, define Cauchy-Riemann relations for the functions to be conformal. 3

b) Show that $f(z) = ln\left(z^2\right)$ satisfy Cauchy-Riemann relations. 4

c) Find $\int_0^\infty \frac{\sin x}{x} dx$, by contour integration. 8

6. a) A trigger pulse is defined by

$\delta(t) = \frac{1}{\tau};\ 0 \le t \le \tau$

$= 0;\ t > \tau \to 0$

Determine the frequency spectrum of this signal and show its graphical representation. 5

b) The probability density function of a random signal is given by :

$p(x) = Ke^{-|x|}$.

Determine the probability of occurrence of outcome X within ±1. 5

c) State and prove Chebyshev's inequality in random process. 5

7. An electrically charged square conducting plate 2a metres on each side is symmetrically placed on the $z = 0$ plane with centre at the origin. If the thickness of the plate is negligible small and $\sigma\ (x, y)$ represents the surface charge density on the plate,

   a) Find an expression of capacitance of the plate

   b) Show graphical representation of the charge density distribution on the plate. 12 + 3

8. A shielded strip line shown below is excited by a voltage IV at the centre plate while the outer shield is grounded. Determine the characteristic impedance of the line using FDM. 15

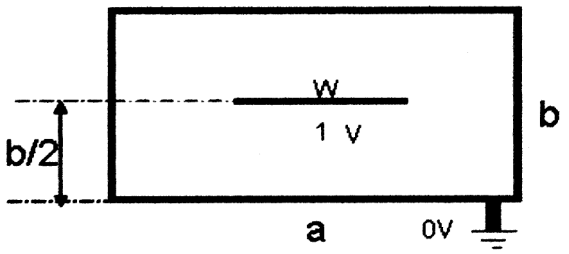

Fig.