COMILLA UNIVERSITY

Faculty of Engineering

Department of Computer Science & Engineering

2nd Year 1st Semester Final Examination '14, Session 2012-2013

Course Code: MATH-215

Course Title: Algebra, Trigonometry and Matrices

Full Marks: 60 **Time: 3 Hours**

Answer any five questions.

N. B. Figures in the right margin indicate marks

1. (a) Define with examples: union and intersection of two sets; difference of two sets and complement of a set. [4]

(b) Prove that $\overline{A \cap B} = \bar{A} \cup \bar{B}$ [4]

(c) Draw the Venn diagram for each of the combinations of the sets A, B and C: [4]

i) $A \cap (B \cup C)$, ii) $\bar{A} \cap \bar{B} \cap \bar{C}$

2. (a) Define function. Using example show that every function is a relation but the converse is not true. [4]

(b) Is f: $R \to R$ given by $f(x) = 1/x$ onto? [3]

(c) Let $f(x) = \frac{2}{\sqrt{x}}$, $x, y > 0$. Find the inverse of f and also state the domains and ranges of f and f^{-1}. [5]

3. (a) State and prove De-Moivre's theorem. [6]

(b) Solve the equation $x^7 + x^4 + x^3 + 1 = 0$ with the help of De-Moivre's theorem [6]

4. (a) Represent graphically the set of values of z for which [6]

a) $\left|\frac{z-3}{z+3}\right| = 2$ b) $\left|\frac{z-3}{z+3}\right| < 2$

(b) Prove that if the ration $\frac{z-i}{z-1}$ is purely imaginary, then the point z lies on the circle whose centre is the point ½ (1+i) and radius $1/\sqrt{2}$. [6]

5. (a) Separate into real and imaginary parts $\tan^{-1}(x+iy)$. [6]

(b) Express $\cosh^5 \theta$ in terms of hyperbolic cosines of the multiple of θ. [6]

6. (a) Describe the meaning of summation of series of n-terms. Also sum to n-terms of the series: [6]

$$\frac{\sin\theta}{\cos\theta+\cos 2\theta}+\frac{\sin\theta}{\cos\theta+\cos 4\theta}+\frac{\sin\theta}{\cos\theta+\cos 6\theta}+\ldots\ldots$$

(b) Find the sum of the following series: [6]

$$\cos 2\theta+2\cos 3\theta+3\cos 4\theta+\ldots..+n\cos(n+1)\theta$$

7. (a) Let $f(x) = -4x^7 + x^3 - x^2 + 2$. Tell the maximum number of real zeroes. Use Descartes rule of signs to determine how many positive, negative and complex zeroes. [4]

(b) Find the multiple roots of $x^4 - 2x^3 + 2x - 1 = 0$ and thus solve the equation. [4]

(c) Find the equation whose roots are those of $x^4 + 10x^3 + 39x^2 + 76x + 65 = 0$ each increased by 4. [4]

8. (a) Find the inverse of the matrix: [6]

$$\bar{A} = \begin{matrix} 1 & 3 & -2 \\ -3 & 0 & -5 \\ 2 & 5 & 0 \end{matrix}$$

(b) Define rank of a matrix. Find the rank of the matrix [6]

$$\bar{B} = \begin{matrix} 1 & 2 & -1 & 2 & 1 \\ 2 & 4 & 1 & -2 & 3 \\ 3 & 6 & 2 & -6 & 5 \end{matrix}$$