COMILLA UNIVERSITY

Department of Computer Science & Engineering

2^{nd} Year 1^{st} Semester Final Examination '13

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 Set, Empty Set, Universal Set, Power Set. [4]

(b) If A={1,2,3}, B={x: x is a prime number less than or equal 13}, C={x, y, z} then find i) BxC, ii) C-B, iii) A∩B, iv) (C∩B) ∩ A [4]

(c) State and prove De Morgan's laws. [4]

2. (a) What do you mean by relation, equivalence relation and partial order relation? [3]

(b) Define with examples i) Mapping, ii) Onto mapping, iii) Into mapping and iv) Inverse function [4]

(c) Find the domain and range of the following functions defined by the rules:

i) $f(x) = [x - 1]$

ii) $f(x) = \begin{cases} x^2, & \text{when } x<0 \\ x, & \text{when } 0<=x<=1 \\ 1/x, & \text{when } x>1 \end{cases}$ [5]

3. (a) State the Cramer's rule. Also solve the following system of linear equations by using Cramer's rule. [2+3]

$$2x+3y+4z=119$$
$$5x-6y+7z=80$$
$$8x+9y+10z=353$$

(b) Define rank of matrix. Find the rank of the matrix [4]

$$\begin{bmatrix} 1 & 0 & 2 & 1 \\ 0 & 2 & 4 & 2 \\ 0 & 2 & 2 & 1 \end{bmatrix}$$

(c) Prove that every square matrix can be uniquely expressed as the sum of the symmetric and skew symmetric matrix. [3]

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4. Define non-singular matrix and adjoint matrix. Solve the following system of linear equations with the help of matrices: [12]

$$x+y+z=9$$
$$2x+5y+7z=52$$
$$2x+y-z=0$$

5. (a) State and prove De Moivre's theorem. [8]

(b) Solve the equation $x^4+x^2+1=0$ with the help of De Moivre's theorem. [4]

6. (a) Expand $\cos\alpha$ and $\sin\alpha$ in ascending power of α. [8]

(b) Show that $1-\frac{2}{3!}+\frac{3}{5!}-\frac{4}{7!}+\ldots\ldots\ldots to\ \infty=\frac{1}{\sqrt{2}}\sin(\frac{\pi}{4}+1)$ [4]

7. (a) State the Decarte's rule of sign and also find the nature of the roots of the equation $-4x^7+x^3-x^2+2=0$ [2+3]

(b) Find the equation whose roots are the roots of the equation $x^5+4x^3-x^2+11=0$, each decreased by 3. [5]

(c) Write the process of synthetic division. [2]

8. (a) Find the nature of the roots of the equation $6x^4-25x3+81x2-9x-13=0$ by using Decarte's rule of signs. [6]

(b) If α, β, λ are the roots of the equation $x^3-px^2+qx-r=0$, obtain the equation whose roots are $\beta\lambda+\frac{1}{\alpha}$, $\lambda\alpha+\frac{1}{\beta}$, $\alpha\beta+\frac{1}{\lambda}$ [6]