



PPD-1656 Seat No. _____

B. Sc. (Sem. II) Examination

April / May - 2016

CC MAT-122 : Mathematics

Time : 3 Hours] [Total Marks : 70

Instructions : (1) All questions are compulsory.
(2) Figures to the right indicate the marks of the corresponding question.

(a) If n is any rational number then prove that 7

$$(\cos\theta + i\sin\theta)^n = \cos n\theta + i\sin n\theta, \text{ where } i = \sqrt{-1}.$$

OR

(a) Expand $\sin n\theta, \cos n\theta, \tan n\theta$, in the power of $\sin\theta, \cos\theta, \tan\theta$ respectively, where $n \in N$.

(b) Attempt any two. 8

(1) If $x = cis\alpha, y = cis\beta, z = cis\gamma$ and $x + y + z = 0$ then prove that

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 0.$$

(2) If $x^2 - 2\cos\theta + 1 = 0$ then prove that

$$x^{2n} - 2x^n \cos n\theta + 1 = 0.$$

(3) Find distinct possible values of $(-1)^{1/6}$

2 (a) State and prove that De'Ambert ratio test. 4
OR

(a) Find the real and imaginary part of $(\alpha + i\beta)^{(x+iy)}$.

(b) Attempt any two :
(1) Discuss the convergence of

$$\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \dots$$

(2) Prove that $\sinh^{-1} z = \log \left(z + \sqrt{z^2 + 1} \right)$.

(3) Find modulus and argument of $(1+i)^{1-i}$

3 (a) Prove in usual notations :

$$\frac{1}{f(D)} e^{ax} V = e^{ax} \frac{1}{f(D+a)} V.$$

OR

(a) Define linear differential equation and write the method of solving it.

(b) Solve any two Differential Equations :

$$(1) (D^2 - 2D + 2)y = e^x + \cos 2x.$$

$$(2) \frac{dy}{dx} + \frac{4xy}{x^2 + 1} = \frac{1}{(x^2 + 1)^3}.$$

$$(3) \frac{dy}{dx} = \frac{x^2 - y^2}{2xy}.$$

- 4 (a) If A and B are $m \times n$ symmetric matrices then prove that $AB - BA$ is a skew symmetric matrix. 7

OR

- (a) If A and B are $m \times n$ and $n \times p$ matrices respectively then prove that $(AB)^T = B^T A^T$.

- (b) Attempt any two :

(1) Find A^{-1} for the matrix $A = \begin{bmatrix} 2 & 1 & 4 \\ 4 & 3 & 1 \\ 1 & 2 & 4 \end{bmatrix}$ 8

(2) For matrix $\begin{bmatrix} 3 & 7-4i & -2+5i \\ 7+4i & -2 & 3+i \\ -2-5i & 3-i & 4 \end{bmatrix}$ is

Hermitian matrix or not?

(3) If $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$ then prove that

$$A^3 = A^{-1}.$$

- 5 Attempt any five :

- (1) Find all positive distinct values of $(-1+i)^{2/5}$.
- (2) Find real and imaginary part of e^{z^2} where $z = x + iy$.
- (3) Discuss the convergence of $\frac{2}{3} + \frac{1}{3} + \frac{1}{6} + \frac{1}{12} + \dots$.
- (4) Find the radius of convergence of $\sum \frac{nx^n}{3^n}$.
- (5) Find integrating factor of $y' - y \tan x = e^x$.
- (6) Define transpose of matrix A. Find transpose

of $A = \begin{bmatrix} 2 & 1 & 1 \\ 4 & 2 & 2 \\ 1 & 2 & 2 \end{bmatrix}$.

- (7) Define symmetric and skew symmetric matrix.