

MANONMANIAMSUNDARANARUNIVERSITY-TIRUNELVELI

UG PROGRAMMES

B.SC MATHEMATICS

VI Semester

JMMA61: Linear Algebra

1.a) Let V be a vector space over F and W a subspace of V . Let $V/W = \{W + v/v \in V\}$.

Then V/W is a vector space over F under the following operations.

(i) $(W + v_1) + (W + v_2) = W + v_1 + v_2$.

(ii) $\alpha(W + v_1) = W + \alpha v_1$.

(or)

b) Let V be a finite dimensional vector space over a field F . Let W be a subspace of V . Then prove that

(i) $\dim W \leq \dim V$.

(ii) $\dim \frac{V}{W} = \dim V - \dim W$.

2.a) The norm defined in an inner product. space V has the following properties.

(i) $\|x\| \geq 0$ and $\|x\| = 0$ iff $x = 0$.

(ii) $\|\alpha x\| = |\alpha| \|x\|$.

(iii) $|\langle x, y \rangle| \leq \|x\| \|y\|$ (Schwartz's inequality).

(iv) $\|x + y\| \leq \|x\| + \|y\|$ (Triangle inequality).

(or)

b) Any square matrix A satisfies its characteristic equation.

(i.e.) if $a_0 + a_1x + a_2x^2 + \dots + a_nx^n$ is the characteristic polynomial of degree n of A then prove that $a_0I + a_1A + a_2A^2 + \dots + a_nA^n = 0$.

JMMA62: Complex Analysis

1.a) Let $f(z) = u(r, \theta) + iv(r, \theta)$ be differentiable at $z = re^{i\theta} \neq 0$.

Then prove that $\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta}$ and $\frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}$. Further $f'(z) = \frac{r}{z} \left(\frac{\partial u}{\partial r} + i \frac{\partial v}{\partial r} \right)$.

(or)

b) Let f be a function which is analytic at all points inside and on a simple closed curve C .

Then prove that $\int_C f(z) dz = 0$.

2. a) State and prove Taylor's theorem.

(or)

b) Expand $f(z) = \frac{z}{(z-1)(2-z)}$ in a Laurent's series valid for (i) $|z| < 1$

(ii) $1 < |z| < 2$ (iii) $|z| > 2$ (iv) $|z - 1| > 1$ and (v) $0 < |z - 2| < 1$.

JMMA63: Mechanics

1.a) Weights W, w, W are attached to points B, C, D , respectively of a light string AE where B, C, D divide the string into 4 equal lengths. If the string hangs in the form of 4 sides of a regular octagon with the ends A and E attached to points on the same level, show that

$$W = (\sqrt{2} + 1) w.$$

(or)

b) Explain three coplanar forces theorem.

2.a) A string $ABCD$ hangs from fixed points A, D carrying a mass of 12 kg at B and a mass of m kg at C . AB is inclined at 60° to the horizontal, BC is horizontal and CD is inclined at 30° to the horizontal. Show that $m = 4$.

(or)

b) Discuss the conditions of equilibrium of three parallel forces.

JEMA61: Graph Theory

1.a) Prove that a simple graph with n vertices and k components can have at most $(n - k)(n - k + 1)/2$ edges.

(or)

b) Prove that i) Any connected graph with n vertices and $n - 1$ edges is a tree

ii) A graph is a tree if and only if it is minimally connected.

2.a) If the edges of a connected graph are arranged in the same order for the columns of the incidence matrix A and the path matrix $P(x,y)$ of a connected graph are arranged in the same order, then the product (mod 2), $A \cdot P^T(x,y) = M$, where the matrix M has 1 's in two rows x and y and the rest of the $n-2$ rows are all 0 's.

(or)

b) Prove that the spherical embedding of every planar 3-connected graph is unique.

JEMA62: Financial Mathematics

1.a) Gill purchases 50 shares of stock in a local firm at \$75.00 per share. He expects to get a dividend of \$4.00 per share at the end of the year. He also expects to sell his shares at \$80.00 each. What is his expected rate of return (r)?

(or)

b) Explain option valuation with examples.

2.a) Explain types of life annuities.

(or)

b) A man had to be hospitalized 6 days for treatment after an accident. The hospital charged \$500 per day, doctors' fees were \$3,620, lab fees were \$987, and ambulance service cost \$340. He has a 80: 20 insurance plans with a \$500 deductible per event. Determine how much he would expect his insurance to pay and how much would fall on him to pay.

JNMA61: MATLAB

1.a) Explain working in the command window.

(or)

b) Explain Built-in functions for handling arrays.

2.a) Ant two examples of MATLAB applications.

(or)

b) Explain plotting multiple graphs in the same plot.