M.SC. MATHEMATICS

SEMESTER III

SMAM31

Name of the Course - Complex Analysis

1.a) State and prove Lucas theorem

(OR)

b) State and prove Abel's theorem

2.a) compute $\int_{|z|=2} \frac{dz}{z^2+1}$

(OR)

b) Suppose that $\phi(\zeta)$ is continuous an arc ν. Then the function $F_n(z) = \int_\gamma \frac{\phi(\zeta)d\zeta}{(\zeta-2)^n}$ is analytic $F_n(z)$. In each of the region determined by ν and the its derivatives is $F'_n(z) = nF_{n+1}(z)$.

SMAM32

Name of the Course - Probability Theory

1.a) Let $\{A_n\}, n = 1,2, \ldots$, be a non -increasing of events and let A be their product. Then $P(A) = \lim_{n\to\infty} P(A_n)$.

(OR)

b) The expected value of the product of an arbitrary finite number of independent random variables \, whose expected values exist, equals the product of the expected values of these variables.

2.a) Find the density function of the random variable X, whose characteristic function is

$$\phi_{1(t)} = \begin{cases} 1 - |t| & for\ |t| \leq 1 \\ 0 & for\ |t| > 1 \end{cases}$$

(OR)

b) Let $(X_1, X_2, \ldots, X_n)$ be an n-dimensional random variable with a normal distribution and let $Y_1, Y_2, \ldots, Y_n$, where $r \leq n$, be linear fractions of random variable $X_j (j = 1,2, \ldots, n)$. Then the

random variable $(Y_1, Y_2, \ldots, Y_n)$ also has a normal distribution.

SMAM33

Name of the Course : Topology

1.a) (i) Let X be a topological space. Suppose that $\mathcal{C}$ is a collection of open sets of X such that each open set U of X and each $x \in U$, there is an element C of $\mathcal{C}$ such that $x \in C \subset U$. Then $\mathcal{C}$ is a basis for the topology of X.

(ii) Let Y be a subspace of X. Then a set A is closed in Y iff A equals the intersection of a closed set of X with Y.

(OR)

b) Let $f: A \to \prod X_\alpha$ be given by the equation $f(a) = \left(f_\alpha(a)\right)_{\alpha \in J}$, where $f_\alpha: A \to X_\alpha$ for each α. Let $\prod X_\alpha$ have the product topology. Then the function f is continuous iff each function f_α is continuous.

2.a) If Y is a subspace of X, a separation of Y is a pair of disjoint non-empty sets A and B whose union is Y, neither of which contains a limit point of the other. The space Y is connected if there exist no separation of Y.

(OR)

b) Prove the followings:

(i) A subspace of a first countable space is first countable.

(ii) A countable product of first countable space is first countable.

(iii) A subspace of a second countable space is second countable.

(iv) A countable product of second countable spaces is second countable.

SMAM34

Name of the Course : Calculus of Variations and Integral Equations

1.a) Determine the point on the curve of intersection of the surface z = xy + 5, x + y + z = 1 which is nearest to the origin.

(OR)

b) Derive Transversality condition

2.a) Derive Green's Function.

(OR)

b) Solve the integral equation y(x) = $\lambda \int (1 - 3x\xi)(\xi) d\xi + F(x)$, for non-homogenous case.

SMAE31

Name of the Course : Mechanics

1.a) State and prove principle virtual work

(OR)

b) A particle of mass m is suspended by a massless wire of length $r = a + b\cos \omega t$, $a, b > 0$. To form a spherical pendulum, find the equation of motion.

2.a) Prove that Bilinear covariant is invariant with respect to canonical transformation

(OR)

b) Derive Hamilton principle function.

SMAS31

Name of the Course : Programming in C++

1. a) Write the differences between structures and unions

(OR)

b) Write a program which illustrates Function Overloading.

2. a) Write a program which illustrates the use of object arrays.

(OR)

b) Write some Operator overloading examples.