MM-08, MM-09, MM-10

(Any three from the following)

OPTION (A). INTEGRAL EQUATIONS AND BOUNDARY VALUE PROBLEMS

(Questions will be set from each unit/section)

Units	Topics
I	Definitions of Integral Equations and their classification. Eigen values and Eigen functions. Fredholm integral equations of second kind with separable kernels. Reduction to a system of algebraic equations. An Approximate Method. Method of Successive Approximations. Iterative Scheme for Fredholm Integral equations of the second kind. Conditions of uniform convergence and uniqueness of series solution. Resolvent kernel and its results. Application of Iterative Scheme to Volterra integral equations of the Second kind. Classical Fredholm Theory. Fredholm Theorems.
II	Integral Transform Methods. Fourier Transform. Laplace Transform. Convolution integral. Application to Volterra integral equations with convolution - type kernels. Abel's equations. Inversion formula for singular integral equation with kernel of the type $(h(s)-h(t)-a$, $O<a<1$. Cauchy's Principal Value of singular integrals. Solution of the Cauchy-type singular integral equation. The Hilbert kernel. Solution of the Hilbert-Type singular integral equation.
III	Symmetric kernels. Complex Hilbert Space. Orthonormal system of functions. Fundamental properties of eigen values and eigen functions for symmetric kernels. Expansion in eigen function and bilinear form. Hilbert Schmidt Theorem and some immediate consequences. Solutions of integral equations with symmetric kernels.
IV	Definition of a boundary value problem for an ordinary differential equation of the second order and its reduction to a Fredholm integral equation of the second kind. Dirac Delta Function. Green's function approach to reduce boundary value problems of a self-adjoint differential equation with homogeneous boundary conditions to integral equation forms. Auxiliary problem satisfied by Green's function. Integral equation formulations of boundary value problems with more general and inhomogeneous boundary conditions. Modified Green's function.
V	Integral representation formulas for the solution of the Laplace's and Poission's equations. Newtonian single-layer and double layer potentials. Interior and exterior Dirichiet and Neumann boundary value problems for Laplace's equation. Green's function for Laplace's equation in a free space as well as in space bounded by a ground vessel. Integral equation formulation of boundary value problems for Laplace's equation.