Differential Equations in Mathematical Physics

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The second part of the course is intended as an introduction to the study of the "algebro-geometric" solutions of the Korteweg - de Vries equation, a nonlinear PDE which describes the motion of shallow water waves under certain conditions.

The starting point is the remarkable observation of Gardner-Green-Kruskal-Miura that the Korteweg – de Vries equation can be derived by deforming the potential of the one-dimensional Schroedinger operator in an isospectral way. This leads, of course, to the study of isospectral classes for the one-dimensional Schroedinger operator.

The following points will be discussed. –

1) The classical spectral theory of the 1-D Schroedinger operator (finite interval, half-line, full line)
2) The Bebutov approach to nonautonomous differential equations
3) The "nonautonomous" approach to the study of the spectral theory of the 1-D Schroedinger operator
4) The algebro-geometric Schroedinger potentials
5) The algebro-geometric solutions of the K–dV equation.

Text: E. Coddington and N. Levinson, "Theory of Ordinary Differential Equations", McGraw-Hill, 1955 and 1984.