

Overview of course

$$A(u) = f \quad \text{for } x \in \Omega \quad (\text{or } (x,t) \in \Omega \times I)$$

Ex.  $A(u) = -\Delta u$  (Poisson equation)

$$A(u) = \dot{u} + \beta_0 \nabla u - \varepsilon \Delta u \quad (\text{Conv.-diff. eqn.})$$

$$A(u) = \dot{u} - \Delta u \quad (\text{Heat eqn.})$$

$$A(u) = \ddot{u} - \Delta u \quad (\text{Wave eqn.})$$

Variational formulation (mult. by test function  
& integrate)

Find  $u \in V$ :  $a(u, v) = L(v) \quad \forall v \in V$

Existence & uniqueness of solutions: Lax-Milgram