**PHY-852 QUANTUM MECHANICS II**
**Homework 11**, 40 points
*April 17 - 26, 2002*
**Time-dependent perturbations**.
Reading: *Merzbacher*, Chapter 19.

1. /8/ *Merzbacher*, Exercise 19.2 (for an arbitrary external force $f(t)$).

2. *a.* /8/ *Merzbacher*, Exercise 19.5 (recall the dipole sum rule discussed in the first semester).

   *b.* /6/ *Merzbacher*, Problem 3, p. 516.

3. /8/ *Merzbacher*, Problem 2, p. 116.

4. $\star$ /10/ *a.* Calculate a transmission coefficient $T(E)$ through a one-dimensional potential barrier

$$U(x) = \left\{ \begin{array}{cc} 0, & x < 0 \text{and} x > a, \\ U_0 > 0, & 0 < x < a. \end{array} \right. \tag{1}$$

   for energies $E \geq U_0$.

   *b.* The same for $0 \neq E \neq U_0$.

   *c.* Find the limiting behavior of $T(E)$ for $E \gg U_0$.

   *d.* Find the limiting behavior of $T(E)$ for $E \to 0$.

   *e.* Find $T(E)$ in the semiclassical approximation and compare with the exact solution.

   *f.* Find the conditions when the barrier can be substituted by the equivalent $\delta$-function barrier.