

**King Fahd University of Petroleum & Minerals**  
***Electrical Engineering Department***  
**EE 306**

**DESIGN PROJECTS**

**Design Project # 1 (Power Factor Correction)**

A three-phase AC motor draws 40 kVA at (pf) power factor lagging from 230-V, 60 Hz supply. It is required to design and install a capacitor bank across the load to ensure that the overall power factor is improved to, at least, 0.95 lagging.

- (a) Find the size of the capacitor bank ( $Q_C$ ) in kVAR in terms of the old (pf). Assume the bank is  $\Delta$ -connected. Show the wiring connections and other illustrations.
- (b) If the ratio of reduction in line current before and after the capacitor bank installation is defined as  $(I_{\text{before}} - I_{\text{after}})/I_{\text{before}}$ , find this ratio in terms of (pf).
- (c) Discuss the economic feasibility of the bank installation.

**Design Project # 2 (DC Motor Starting)**

An automatic starter is to be designed for a 10-hp, 230-V shunt motor. The resistance of the armature circuit is  $0.20 \Omega$  and the resistance of the field circuit is  $115 \Omega$ . The field winding is connected directly across the 230-V. When operated at no load and rated voltage, the armature current is 4 A and the motor runs at a speed of 1180 rpm. When the motor is delivering the rated output, the armature current is 37 A. The resistance in series with the armature is to be adjusted automatically so that during the starting period the armature current is allowed to rise up to but not exceed twice the rated value. As soon as the current falls to rated value, sufficient series resistance is to be cut out to allow the current to increase once more. This process is repeated until all the series resistance has been cut out.

- (a) Determine the total resistance of the starter.
- (b) Calculate the resistance that should be cut out at each step in the starting process.

**Grading and Submission**

Grading will be primarily based on correct results and the clarity of the output results. Writing style and organization (comments, consistency, etc.) will also be graded.

**The report must be submitted no later than Sunday January 16, 2010.**