

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

King Fahd University of Petroleum and Minerals  
Department of Electrical Engineering

Semester I 2005/2006

EE445 Industrial Electronics

Final Test

**ATTEMPT ALL QUESTIONS  
TIME ALLOWED THREE HOURS**

Q1. It is required to monitor the water level in a boiler. To achieve this, three levels of the water have to be detected. When the water level exceeds a certain maximum value, say 10m, when it is half way in the boiler, that is at 5 m, and when it is too low in the boiler, that is at 1 m. Assume that the water level sensors are available and that they are producing the right voltages corresponding to the different levels of water inside the boiler.

You are requested to design a system that will give an **alarm only** when the water level is either at its maximum or minimum level and that will give flashing-light indicators to when the water arrives any of the three levels.

**Draw a complete circuit diagram of your proposed design, write the most important specifications of your components and a brief description of your design.**

Q2. In a public hall it is required to use 15 lamps for illumination. The lamps are divided into 5 sets, each set comprises 3 lamps in a row. In order to save energy it is required to control the illumination using a low-power (say 1/4 W) variable resistance that can be manually adjusted. Each set is expected to be independently controlled. That is you can adjust one set without affecting the others. Each lamp is 200W/120V AC.

You are requested to design a system that will perform this light intensity control.

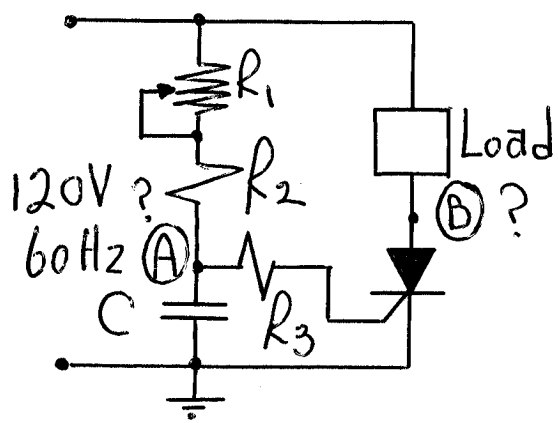
**Draw a complete circuit diagram of your proposed design, write the most important specifications of your components and a brief description of your design.**

Q3. In an industrial organization there is a DC motor that requires 25V for its armature winding to work at full speed. There is no DC supply available to do this. It is decided to use the AC mains voltage to obtain the required DC voltage. Also it is required to control the speed of this motor by adjusting the DC voltage of the armature winding using a low-power (say 1/4 W) resistor.

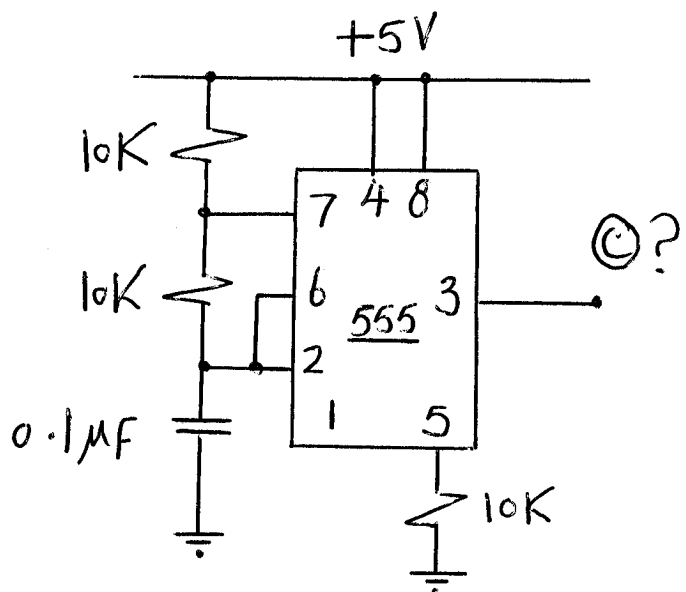
You are requested to suggest a circuit that will convert the AC mains voltage to DC voltage. Also you are requested to design the circuit that will control the speed of the motor.

**Draw a complete circuit diagram of your proposed design, write the most important specifications of your components and a brief description of your design.**

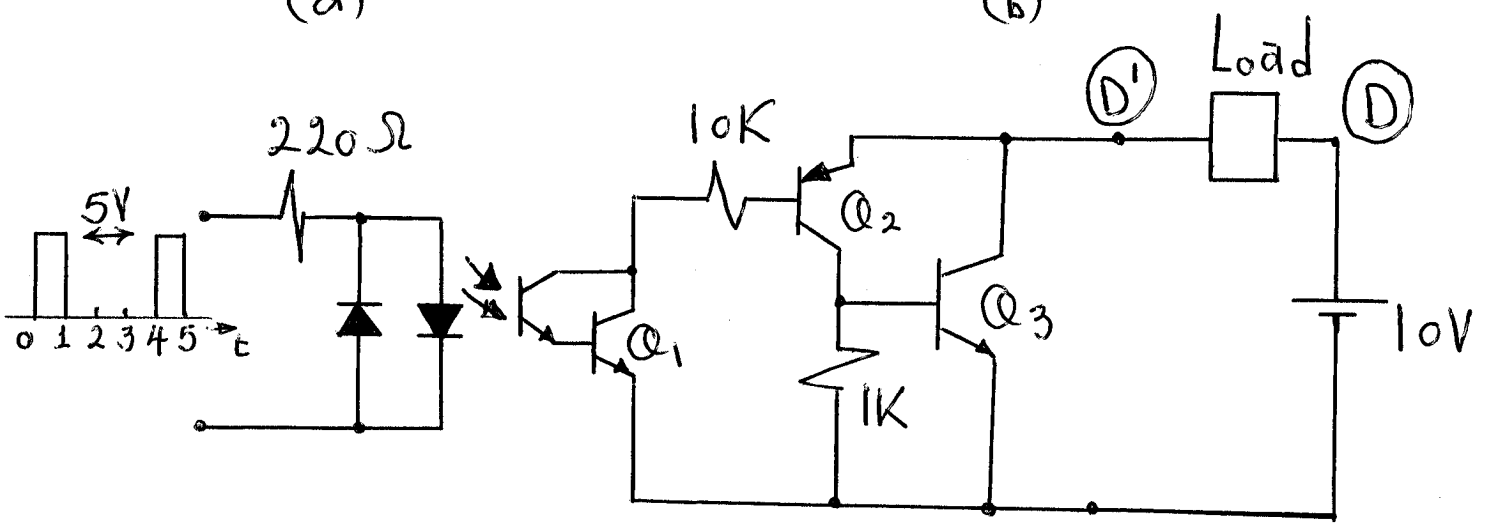
Q4. Sketch the output waveform at the designated points shown in the figure below.



(a)

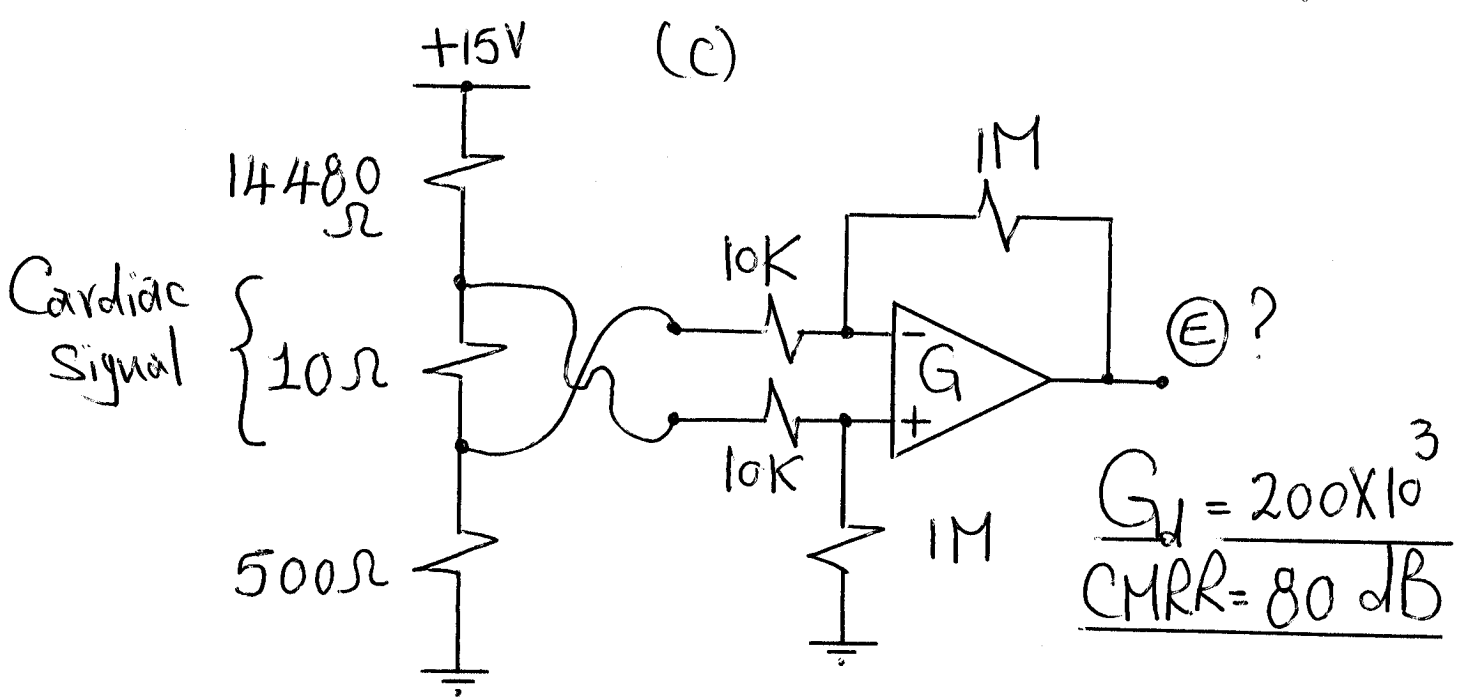


(b)



Voltage between D-D' ?

(c)



(d)