PROBLEM SHEET 3

Alternating current

1. A wire frame of area $S = 0.1$ m^2 is rotated with frequency $f = 100$ Hz in magnetic field of induction $B = 2$ T. For the induced alternating EMF, determine:
   a) Angular frequency ω;
   b) Period T;
   c) Amplitude $\mathcal{E}_m$;
   d) Peak-to-peak amplitude $\mathcal{E}_{pp}$;
   e) R.m.s. amplitude $\mathcal{E}$.
2. A 100 Ω resistor is connected to a power source of 100 V a.c. Determine:
   a) Effective current;
   b) Amplitudes of current and voltage;
   c) Peak-to-peak amplitudes of current and voltage.
3. For a power source of 100 V at 50 Hz, the instantaneous value of voltage at the initial moment of time $t = 0$ is zero. Determine the instantaneous values of voltage and phase after:
   a) 1/12 of a cycle; b) 1/8 of a cycle; c) 1/6 of a cycle; d) 1/4 of a cycle;
   e) 1/3 of a cycle; f) 3/8 of a cycle; g) 5/12 of a cycle; h) 1/2 of a cycle.
   Express the phase both in radians and in degrees.
4. A 75 Ω resistor is connected to a power source of 150 V at 50 Hz. At the initial moment of time $t = 0$, the instantaneous value of the voltage was zero, and that of the current was 2 A. Determine:
   a) Phase shift φ between voltage and current;
   b) Time interval Δt which corresponds to this phase shift;
   c) Power factor;
   d) Apparent power;
   e) Active power consumed in the resistor.
5. **ASSIGNMENT**. A 100 Ω resistor is connected to a power source of 100 V at 50 Hz. At the initial moment of time $t = 0$, the instantaneous value of the voltage was zero, and that of the current was 0.7 A. Determine:
   a) Phase shift φ between voltage and current;
   b) Time interval Δt which corresponds to this phase shift;
   c) Power factor;
   d) Apparent power;
   e) Active power consumed in the resistor.
6. (*) For a power source of 100 V a.c., determine the average value of voltage over one halfcycle. For this, you will need to take integral of voltage over a half-cycle. See more details in the textbook.