

Ollscoil na hÉireann, Gaillimh

National University of Ireland, Galway

SEMESTER II EXAMINATIONS, 2000/2001

THIRD YEAR ELECTRONIC ENGINEERING
THIRD YEAR MECHANICAL ENGINEERING

ELECTRICAL POWER AND MACHINES

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$$\mu_0 = 4\pi \times 10^{-7} \text{ H/m} \quad 1 \text{ hp} = 746 \text{ W}$$

Q1 Describe the 2 watt meter method of measuring power in a 3 - phase system.

In the 3 - phase balanced system shown in Figure 1, the load $Z = (8 + j6) \Omega$ and $V_{ab} = 200 \angle 0^\circ (\text{rms})$ and the phase sequence is a, b, and c. Draw the phasor diagram of voltages and currents and calculate:

- the phase currents
- the line currents
- the total 3-phase power
- the wattmeter readings W_1 and W_2

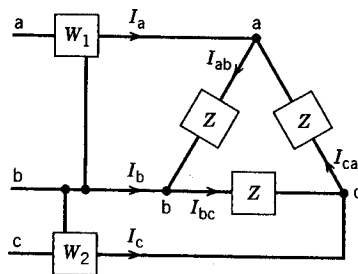


Figure 1

Q2 Explain the terms: triplen harmonics and total harmonic distortion

An e.m.f. represented by the equation :

$$e(t) = 200 \sin \omega t + 30 \sin (3\omega t - \pi/6) + 15 \sin (5\omega t + \pi/3)$$

where $\omega = 314 \text{ r/s}$, exists in a circuit consisting of a coil ($R = 12 \Omega$, $L = 45 \text{ mH}$) in series with a variable capacitor.

- Calculate the value of the capacitance which will give resonance with the triple frequency component of the e.m.f.
- Write down the corresponding equation for the current and determine its r.m.s. value

Q3 Describe with the aid of a sketch the main losses in an induction motor

A three-phase, 460 V, 1450 rpm, 50 Hz four-pole wound - rotor induction motor has the following parameters per phase:

$$R_1 = 0.25 \Omega$$

$$X_1 = X_2' = 0.5 \Omega$$

$$R_2' = 0.2 \Omega$$

$$X_0 = 30 \Omega$$

With the rotor terminals short circuited, calculate:

- (a) the starting current and starting torque
- (b) the full load torque

Q4 Write a note of one of the following forms of alternative energy under the following headings:

- Basic technology
- Applications
- Costs
- Future potential

- (a) Photovoltaics
- (b) Wind Energy
- (c) Fuel Cells