

UNIVERSITY OF REGINA
FACULTY OF ENGINEERING

EN 382 FINAL EXAM
ENEL

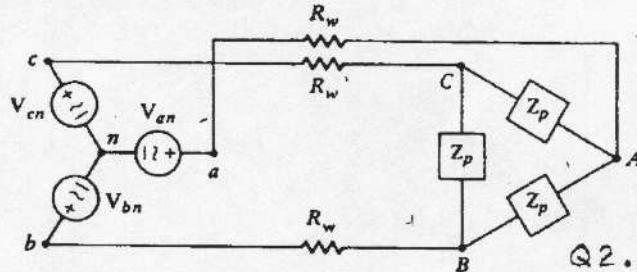
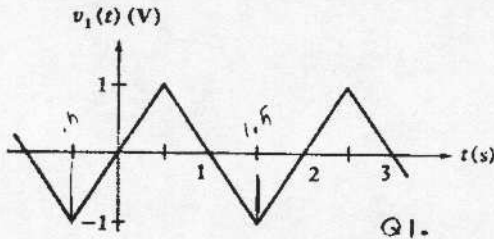


INSTRUCTOR: K. J. RUNTZ

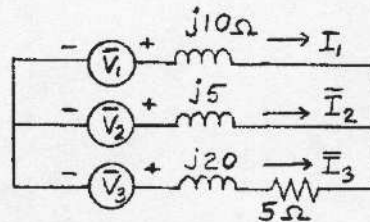
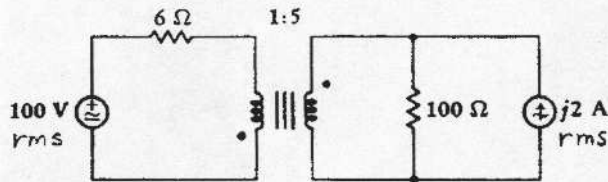
1992 April 14
9:00 - 12:00

MARKS: Q1 = 10% Q2 = 15% Q3 = 20% Q4 = 15%
Q5 = 10% Q6 = 30%

1. The voltage $v_1(t)$ is applied across a 50 ohm resistor. Calculate the average power dissipated by the resistor.



2. Given $Z_p = 12 + j 6$ ohm, $R_w = 0.8$ ohm, $\bar{V}_{CA} = 100 \angle 20^\circ$ V rms, a-b-c phase sequence. Find: (a) \bar{V}_{AB} ; (b) \bar{I}_C ; (c) the total complex power supplied by the source.
3. Three electrical devices are connected in parallel: 3 kVA at 0.707 PF leading, 7 kVA at 0.8 PF lagging, and a series RL load with $R = 2$ ohm and $L = 10.61$ mH. This composite load is supplied with power from an ideal 100 V rms, 60 Hz sinusoidal voltage source. Find: (a) the power factor at which the source is operating; (b) the source current rms magnitude; (c) the capacitance that must be placed in parallel with the composite load so that the power factor will be 0.95 lagging.
4. Find the real power absorbed by the 6 ohm resistor.
5. A single phase equivalent circuit of a balanced three phase system is shown. The sources represent synchronous motors or generators. Find: (a) which sources are operating as motors and which are operating as generators; (b) the real and reactive power supplied or absorbed by each machine.



$$\begin{aligned} \bar{V}_1 &= 1000 + j 0 \text{ Vrms} & \bar{I}_1 &= 10\sqrt{2} \angle -135^\circ \text{ Arms} \\ \bar{V}_2 &= 1050 + j 150 & \bar{I}_2 &= \bar{I}_1 \\ \bar{V}_3 &= 800 + j 200 & \bar{I}_3 &= 20\sqrt{2} \angle 45^\circ \end{aligned}$$

Q5.

6. (a) Explain the terms: commutator, squirrel cage, slip ring, armature, synchronous reactance, stator.

(b) Consider yourself an engineer specifying motor drives for a large industrial plant. Compare the relative pros and cons of synchronous and induction motors.

(c) A 10 pole, 3 phase induction motor is to be used with a 400 Hz supply. The motor is rated for full load at 5 % slip. Calculate its full load speed in rpm.

(d) True or false. (Do not guess. Incorrect answers will be subtracted from correct answers.)

___ A. An induction motor can operate continuously at speeds covering a wide range up to about 95 % of synchronous speed.

___ B. A DC voltage is applied to the stator windings of a synchronous machine.

___ C. A wound rotor in an induction motor is sometimes used with external resistance to provide a higher operating speed.

___ D. The direction of rotation of an induction motor could be reversed if two of the three connections to the 3-phase supply are interchanged.

___ E. The direction of rotation of a synchronous machine can be reversed by switching the polarity of the DC supply to the field winding.

___ F. An induction motor develops zero torque at synchronous speed.

___ G. A synchronous motor develops maximum torque at synchronous speed.

___ H. DC motors can be operated over a wide range of speeds but have low starting torque.

___ I. DC motors will rotate in the opposite direction if the polarity supplied to the armature is reversed.