

NAME: [REDACTED]



UNIVERSITY OF REGINA
FACULTY OF ENGINEERING
ENEL 382 - 1995 FALL
FIRST MIDTERM EXAMINATION

13/15

COURSE TITLE: ELECTRIC POWER SYSTEMS
INSTRUCTOR: JACK D. KATZBERG
DATE: 4 October 1995
TIME ALLOWED: 50 MINUTES.
INSTRUCTIONS: No Books, notes or calculators are allowed.

Part A: 10 marks (All questions are of equal value.)

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1. In 1819, Oerstedt discovered that electricity and magnetism are linked.

2. How is the voltage induced in a circuit related to magnetic flux?

$$B = \frac{v^2}{2\pi r \mu} \quad v = N \frac{d\Phi}{dt}$$

3. How is the force on a conductor carrying a wire related to magnetic flux?

$$F = B \frac{d\Phi}{dt} \quad F = i(l \times B)$$

4. Lenz's Law states that the induced voltage is such as to produce a current which will in turn produce a flux which opposes the original flux.

5. DC Motors are used where a variable speed drive is needed.

6. The 3phase induction motor is compact, cheap and highly efficient but it requires three phase power.

7. Practical generators usually have three windings each displaced from one another by 20°.

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8. What is the relationship between the synchronous speed, the power frequency and the number of poles in an AC machine?

$$n_s = \frac{120f}{P} \quad \checkmark \quad (\text{gives answer in rpm})$$

9. Slip is defined to be:

$$s = \frac{n_s - n_m}{n_s} \quad \checkmark$$

$n_s = \text{sync speed}$
 $n_m = \text{rotor speed}$

10. A wound rotor induction motor has its rotor terminals brought out through slip rings so the rotor resistance can be changed
thus changing slip, torque, etc \checkmark

11. The efficiency of a Class A three phase squirrel cage induction motor is typically 87-89%. \checkmark

12. In a Split Phase Motor the auxiliary winding consists of high
resistance wire. \checkmark

13. When a Split Phase motor gets up to a specified speed a centrifugal switch switches out current through the auxiliary winding. \checkmark

14. The Capacitor-Start Capacitor-Run Motor has a permanently connected capacitor and a second capacitor connected through a switch. \checkmark
(centrifugal)

15. The efficiency of a general purpose split-phase induction motor is typically 67%. \checkmark

16. In environments where hydrocarbons are present or where methane build up is possible explosion proof enclosure should be used. \checkmark

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17. In an AC network the average power consumed in an element is:

Voltage across \times current through

$$P = IV \cos \theta = I^2 R = \frac{V^2}{R}$$

18. The power factor is the:

$$pf = \frac{\text{power in}}{\text{voltage} \times \text{current}}$$

19. You should ground (deenergize) your circuit before doing any work on it.

20. When working in an electrical laboratory you should avoid exposing your self to currents through the chest region.

Part B: 5 marks

1. In the circuit of Figure 1, produce a expression that can be used to computed the phasor associated with $v_b(t)$ from the phasor associated with the voltage source $v(t)$.

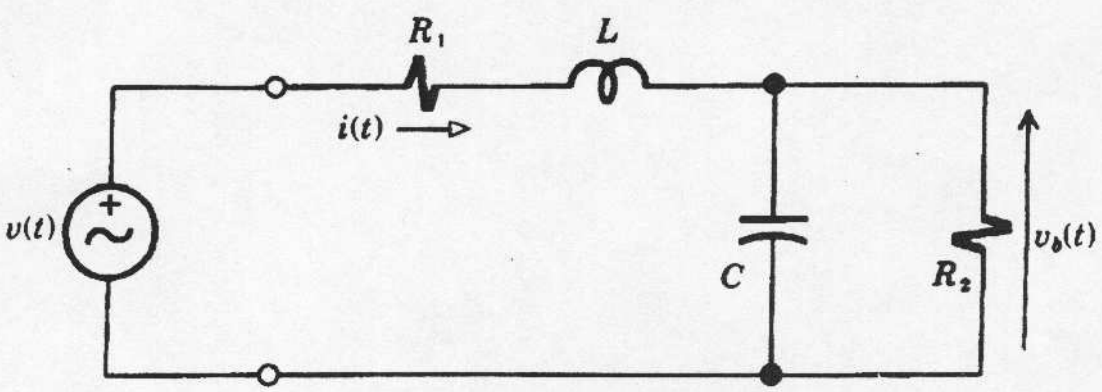


FIGURE 1

Answer:
 Cond. & res are in ||

$$Z_{CR_2} = \frac{R_2(j\omega C)}{R_2 + j\omega C}$$

by voltage division

$$\tilde{V}_b = \tilde{V} \frac{Z_{CR_2}}{R_1 + j\omega L + Z_{CR_2}}$$

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