A 90 B 30 2
B 80 15 20 1
C 70 6
D 60 5
5 0 2
F 40 8

Ag& Bio Engineering Department 2/1/07
ISU CJB

Name KEY

TSM 363 Exam 1

Open: one 8 1/2x11 page both sides
Part 1: Multiple choice, 1 point each

1) In an AC circuit, power is used by
   a) resistances
   b) capacitances
   c) inductances
   d) all of the above
   e) (a) & (b)
   f) (a) & (c)
   g) (b) & (c)

2) When a load is connected between the negative and positive poles of a battery,
   a) electrons flow from the negative through the load to the positive
   b) electrons flow from the positive through the load to the negative
   c) electrons might flow either way, depending on whether an AC or DC load is connected.
   d) electrons flow into the load from both poles, and are used up as heat in the load.

3) When an extra series load is added to a series circuit,
   a) voltages across and currents through other loads are not changed.
   b) voltages change, but currents remain the same.
   c) currents change, but voltages remain the same.
   d) voltages across and currents through other loads change.

4) When current is flowing through an electrical circuit,
   a) an open circuit exists.
   b) a closed circuit exists.
   c) a short circuit exists
   d) (a) or (c)
   e) (b) or (c)
   f) (a) or (b)

5) Materials which are good insulators
   a) have many free electrons.
   b) have few free electrons.
   c) have no electrons
   d) must have no resistance.
   e) have atoms which are positively charged

6) The fundamental principle of all electromagnetic generators is
   a) move a current carrying conductor through a magnetic field and a force will be exerted on the conductor.
   b) move a conductor at right angles to the lines in a magnetic field and a current is induced to flow in the conductor.
   c) place the junctions of wires of two dissimilar metals in regions of different temperatures and a current flows through the wires.
   d) a current-carrying conductor tends to move at right angles to field lines when placed in a magnetic field.

7) If two ammeters are placed in parallel with each other, but in series with a load,
   a) both will read the correct load current.
   b) neither will read the correct load current.
   c) they will shut off current to the load.
   d) they will cause a short circuit and may be damaged.

8) A voltmeter placed in series with a load will
   a) cause a short circuit but no damage to the meter
   b) read correctly the voltage across the load
   c) shoutoff almost all current to the load
   d) cause a short circuit and ruin the meter
   e) read correctly the voltage across the load

9) The common type of alternating current meter indicates on its dial:
   a) the actual current in the conductor.
   b) the average current.
   c) the peak current.
   d) the square root of the mean of the instantaneous current squared.

10) The volt amps drawn by a load equal the watts drawn by the load -
   a) always
   b) never
   c) when PF < 1
   d) when PF > 1
   e) when PF = 1

11) Negative instantaneous power in an AC circuit
   a) means energy stored in a reactive load component is flowing from the load to the generator.
   b) is impossible.
   c) means that resistive load components are adjusted to lower voltage by passing stored energy back to the generator.
   d) occurs only at power factors less than 0.5.

12) How long will it take a 4kW load to use 12 kWh of energy?
   a) 3 hour
   b) 1/3 hour
   c) 36 minutes
   d) 3.6 hours
   e) none of the above

$(4kW)(3h) = 12kWh$

13) Which of the following loads can be assumed to operate at power factor of 1?
   a) transformer welder
   b) fluorescent lamp
   c) toaster
   d) capacitor start induction run motor

14) A 120-volt appliance has a power factor of 0.6 and uses 850 watts. The current flowing to the appliance is:
   a) 11.8 amps
   b) 7.08 amps
   c) 4.25 amps
   d) 0.235 amps
   e) none of the above

$850 = 120(I)(.6)$

$I = 11.8$

15) The purpose of the National Electrical Code is to
   a) safeguard persons, buildings, and contents from electrical hazards.
   b) insure that electrical systems are economical and efficient.
   c) insure that electrical systems have adequate capacity
   d) a & b
   e) b & c
   f) a & c

16) Severity of an electrical shock depends on
   a) magnitude of current.
   b) duration of shock.
   c) route through body.
   d) all of the above.
   e) a & b
   f) a & c

17) The purpose of giving CPR to an unconscious shock victim is to
   a) revive the person.
   b) prevent stoppage of the heart.
   c) prevent ventricular fibrillation from occurring.
   d) keep person alive until defibrillation assistance can arrive.

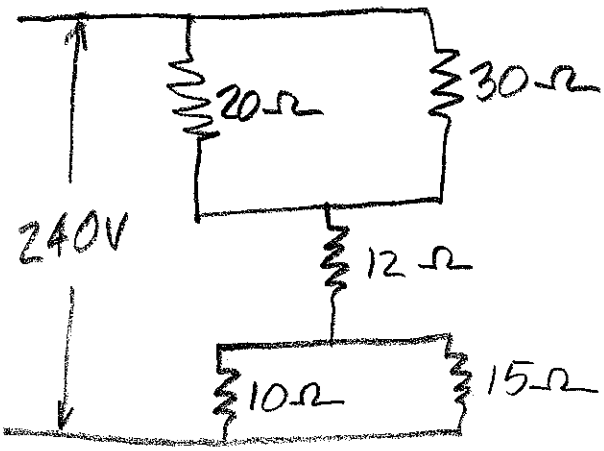
18) If a 240-volt load has no connection to neutral,
   a. the load will work, but not very well
   b. the load will not operate
   c. this violates code
   d. the load works normally

19) The maximum instantaneous voltage to ground occurring on a 120/240 v single phase system is about:
   a) 240 V
   b) 120 V
   c) this depends on the type of meter used.
   d) 170 V
   e) 0 V
   f) 84.6 V
   g) 115 V

20) If two equal-wattage 120-volt light bulbs are placed in series across 240 volts,
   a. they will both operate normally
   b. one will burn out in a short time and open the circuit
   c. they will both light, but light output will be greatly reduced
   d. both will light, but the bulb nearer the source of electrons (negative terminal) will be brighter

Part 2
Show all work: No work = no credit

(22) 21)



$\frac{1}{R} = \frac{1}{20} + \frac{1}{30} = \frac{3+2}{60}$

$R = 12\Omega$

12

$\frac{1}{R} = \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30}$

$R = 6\Omega$

30Ω

7 Compute: Equivalent resistance of entire circuit

7 E across 12-ohm resistor

$I = \frac{240}{30} = 8A$

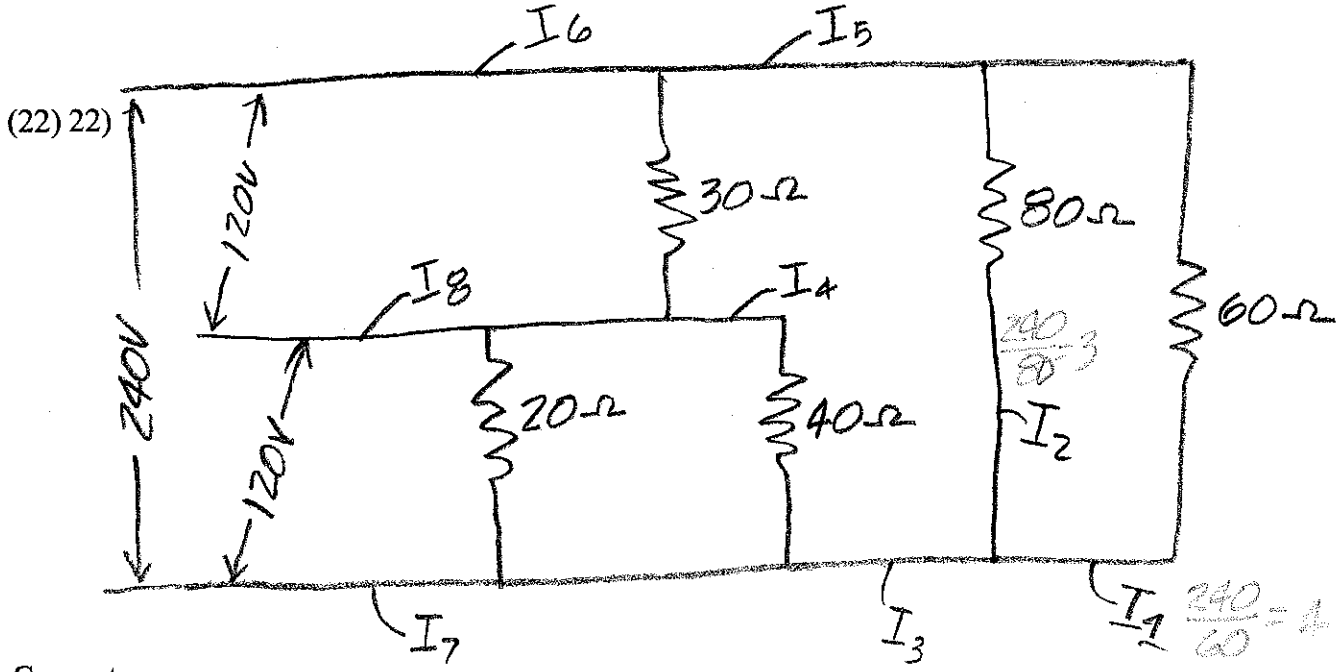
$E = (8)(12) = 96V$

8 Power used by 15 ohm resistor

$E = 8(6) = 48$

$I = \frac{48}{15} = 3.2$

$I^2R = (3.2^2)(15) = 153.6W$



Compute:

I1 = 4 A

I2 = 3 A

I3 = 7 A

I4 = 3

I5 = 7 A

I6 = 11 A

I7 16 A

I8 5 A

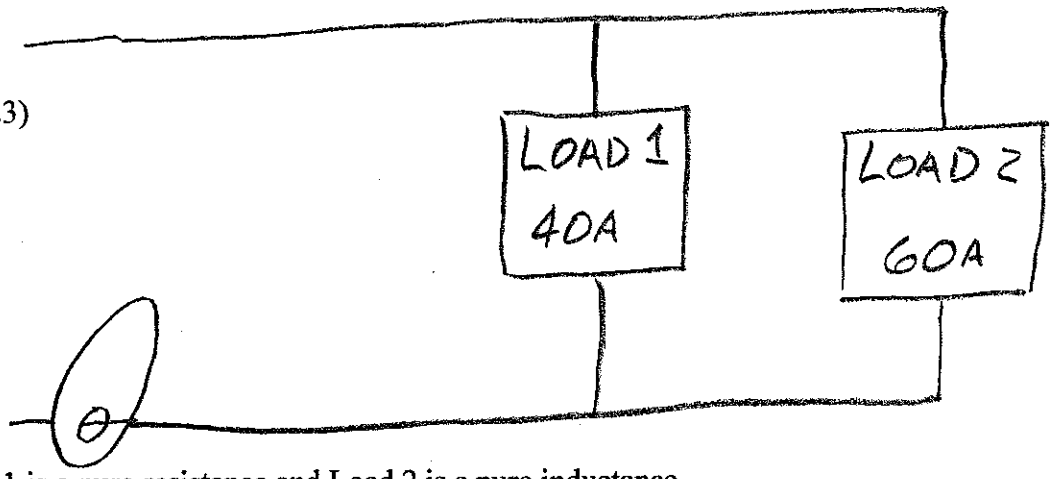
Total power used by the circuit

$P_{240} = (240)(7) = 1680$

$P_{120} = (120)(13) = 1560$

$3240\ W$

(21) 23)



Load 1 is a pure resistance and Load 2 is a pure inductance.

(a) Sketch a phasor diagram showing the current of Load 1 and the current of Load 2.

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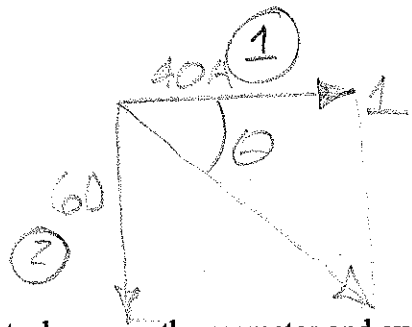


40+j0

0-j60

40-j60

(b) Compute the current shown on the ammeter and express in polar and rectangular notation.

13

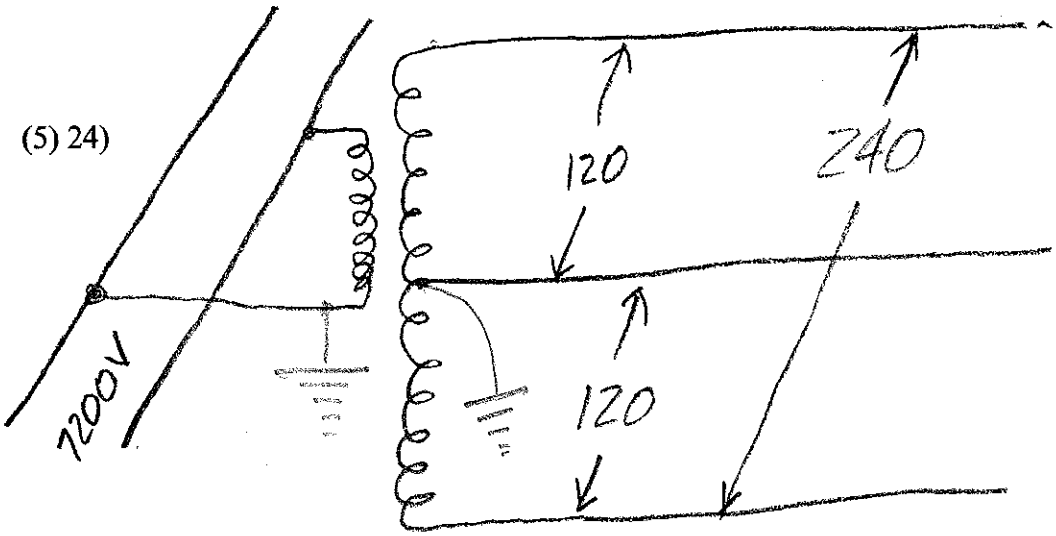
$\tan\theta = \frac{60}{40} = 56.3°$

$I \cos 56.3 = 40$

$I = 72.1\,A$

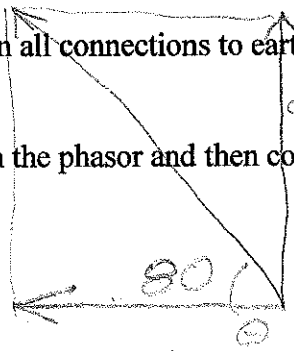
$\tilde{I} = 72.1 \angle -56.3$

(5) 24)



Draw in all connections to earth

(5) 25) Sketch the phasor and then convert to polar notation: -80 + j96



$\tan\theta = \frac{96}{80} = 1.2$

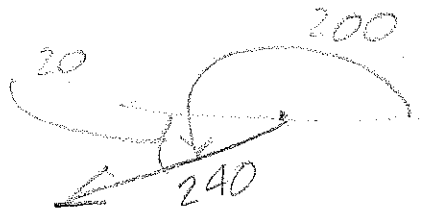
$\theta = 50.2°$

$180 - 50.2 = 129.8$

$E \angle 50.2 = 80$

$\vec{E} = 125.0 \angle 129.8°$

(5) 26) Sketch the phasor and convert to rectangular notation: $240 \angle 200°$



$240 \cos 20 = 226$

$240 \sin 20 = 82.1$

$\vec{E} = -226 - j82.1$