TEST 1 – Electricity & Basic Principles

Problem 1:

A positively charge dielectric has a charge of 2 coulombs. If 12.5 x 10^{18} free electrons are added to it, what will be the net charge on the said dielectric?

A. 4 C B. –2 C C. 8 C D. Zero

Problem 2:

A battery can deliver 10 joules of energy to move 5 coulombs of charge. What is the potential difference between the terminals of the battery?

A. 2 V B. 50V C. 0.5 V D. 5 V

Problem 3:

A cloud of 2.5 x 10^{19} electrons move past a given point every 2 seconds. How much is the intensity of the electron flow?

A. 1 A B. 2 A C. 2.5 A D. 1.5 A

Problem 4:

A current in an electric lamp is 5 amperes. What quantity of electricity flows towards the filament in 6 minutes?

A. 30 C B. 3600 C C. 72 C D. 1800 C

Problem 5:

A constant current of 4 A charges a capacitor. How long will it take to accumulate a total charge of 8 coulombs on the plates?

A. 2 s B. 32 s C. ½ s D. 12 s

Problem 6:

The substation bus bar is made up of 2-inches round copper bars 20 ft. long. What is the resistance of each bar if resistivity is 1.724 x 10-^{6} ohm-cm.

A. 7.21 x 10^{-5} ohm B. 13.8 x 10-^{6} ohm

B. 5.185 x 10^{-5} ohm D. 2.96 x 10^{-5} ohm

Problem 7: EE Board October 1997

Determine the resistance of a bus bar made of copper if the length is 10 meters long and the cross-section is a 4 x 4 cm^2. Use 1.7241 micro ohm-cm as the resistivity.

A. 2.121 x 10^{-4} ohm

B. 4.312 x 10^{-4} ohm

C. 3.431 x 10^{-5} ohm

D. 1.078 x 10^{-4} ohm

Problem 8:

Nichrome ribbon resistor elements each has a resistance of 1 ohm. The element is made from sheet of Nichrome alloy, 0.025 cm thick. If the width of the ribbon is 0.03 cm, what length is required per element? Assume specific resistance of Nichrome alloy to be 109μΩ- cm.

A. 68.8 cm B. 62.1 cm C. 70.7 cm D. 67.4 cm

Problem 9: EE Board October 1991

One turn of a copper bar is produced by cutting a copper washer along a radius and spreading the ends. The washer is cut from soft-drawn copper having a resistivity at 20^{o} C of 1.732 x 10^{-6} ohm-cm. The washer is 0.125 inch thick and has inside and outside diameter of 1 inch and 9 inches respectively. Calculate the exact resistance between the two ends of a turn to direct current, taking into account the non-uniform current distribution. Assume the contact along the ends of a turn to be perfect over the entire cross-section.

A. 12.74 x 10^{-6} ohm B. 15.53 x 10^{-6} ohm C. 17.22 x 10^{-6} ohm D. 14. 83 x 10^{-6} ohm

Problem 10: EE Board October 1990

Determine the resistance of a conductor 0.10 m long, with a uniform diameter of 1.0 cm and having a resistivity which varies as a function length L measured from one end of the conductor according to the formula: $\rho = 0.003 + 10^{-4} L^2$ ohm-cm.

A. 0.0852 ohm
B. 0.0915 ohm
C. 0.0806 ohm
D. 0.0902 ohm

Problem 11: EE Board April 1992

A coil has 6, 000 turns of wire and a resistance of 380 ohms. The coil is rewound with the same quantity (weight) of wire, but has 13, 400 turns. How many ohms will the new coil have?

A. 1895 ohms
B. 1825 ohms
C. 1792 ohms
D. 1905 ohms

Problem 12: EE Board April 1992

A copper of unknown length has a resistance of 0.80 ohm. By successive passes through drawing dies, the length of the wire is increased to 2 ½ times its original value. Assuming that resistivity remains unchanged during the drawing process, determine the new value of its resistance.

A. 4 Ω
B. 3 Ω
X. 5 Ω
Δ. 6 Ω

Problem 13: EE Board October 1998

A one- meter rod of 2- cm diameter is drawn until its resistance is 100 times the initial resistance. Its length afterward is?

A. 10 m
B. 100 m
C. 12.5 m
D. 5 m

Problem 14: EE Board April 1993

A kilometer of wire having a diameter of 11.7 mm and a resistance of 0.031 ohm is drawn down so that its diameter is 5.0mm. What does its resistance become?

A. 0.85 ohm
B. 0.78 ohm
C. 0.93 ohm
D. 0.81 ohm

Problem 15:

A conductor whose diameter is 0.175 inch has a resistance of 0.5 ohm. The wire is drawn through a series of dies until its diameter is reduced to 0.08 inch. Assuming the specific resistance of a material remains constant, what is the resistance of lengthened conductor?

A. 11.45 Ω
B. 10.22 Ω
X. 12.75 Ω
Δ. 10.82 Ω

Problem 16:EE Board April 1995

A certain wire has a resistance R. The resistance of another wire identical with the first except for having its diameter is

A. 4R
B. (1/2) R
C. 2R
D. (1/4) R

Problem 17:

A given wire has a resistance of 17.5 ohms. If its length is 560 m, how much length is must be cut off from the wire in order to reduce its resistance to 12.5 ohms.

A. 160 m B 170 m C. 145 m D. 155 m

Problem 18:EE Board October 1996

What is the size in square millimeter (mm^2) is the cable of 250 MCM size?

A. 118.656 mm^2 B. 126.675 mm^2 C. 112.565 mm^2 D. 132.348 mm^2

Problem 19:

A 500 MCM ACSR cable has 37 strands. Determine the diameter in mils of each strand.

A. 116.25 B. 120.24 C. 118.34 D. 110.35

Problem 20:

A copper transmission line is to be replaced by one of aluminum having the same total resistance. If the cross sectional area of the copper wire is 500 MCM, what would be the cross sectional area of the new aluminum wire?

A. 800 MCM B. 820 MCM C. 850 MCM D. 900MCM

Problem 21:

The resistance of a copper wire at 30°C is 50 ohms. If the temperature coefficient of copper at 0°C is 0.00427, what is the resistance at 100°C?

A. 72.26 ohms B. 54.25 ohms C. 63.24 ohms D. 58.15 ohms

Problem 22:

The shunt field winding of a shunt generator has a resistance of 80 ohms at 20°C. After several hours of continuous operation, the winding temperature rises to 50°C. How much is the winding resistance under this condition. Assume the resistance temperature coefficient of copper to be 0.004 ohm per degree at 0°C.

A. 88.89 Ω B. 90.12 Ω C. 85.22 Ω D. 92.81 Ω

Problem 23:

The field windings of a series motor has a resistance of 120 ohms at 15°C. After running for two hours, the resistance increases to 140 ohms. If the temperature coefficient of the windings at 0°C is 0.004, find the new temperature of the windings.

A. 60.4 °C B. 59.2 °C C. 58.4 °C D. 53.7 °C

Problem 24:EE Board March 1998

The resistance of a wire is 126.48 ohms at 100 °C and 100 ohms at 30 °C. Determine the temperature coefficient of copper at 0 °C.

A. 0.00427 B. 0.00615 C. 0.0256 D. 0.0356

Problem 25:

Two wires A and B are made from two different materials have temperature coefficient of resistance equal to 0.0025 and 0.0005 ohm per °C, respectively. It is desired to make a coil of wire having a resistance of 1200 ohms with a temperature coefficient of 0.001, using suitable lengths of the two given wires connected in series. Determine the required length of wire A?

A. 5.5 m B. 6.2 m C. 6.0 m D. 5.0

Problem 26:

Two heating elements which is 500 ohms and 250 ohms are connected in series with temperature coefficients of 0.001 and 0.003 ohms per °C, respectively at 20 °C. Calculate the effective temperature coefficient of the combination.

A. 0.00215 B. 0.00626 C. 0.00712 D. 0.00167

Problem 27:

A cylindrical rubber insulated cable has a diameter of 0.18 inch and an insulation thickness of 0.25 inch. If the specific resistance of rubber is 10^{14} ohm-cm, determine the insulation resistance per 1000-ft length of the cable.

A. 624 M Ω b. 682 MΩ C. 678 MΩ D. 694 MΩ

Problem 28:

The diameter of a given bare conductor is 0.50 inch. A thermoplastic insulation with the thickness of 0.1 inch is wrapped around to insulate the conductor. Determine the insulation resistance of this conductor per meter. Assume specific resistance of thermoplastic insulation to be 2×10^{14} ohm-cm.

A. $107\times10^{9}\Omega$ B. $105\times10^{9}\Omega$ C. $110\times10^{9}\Omega$ D. $109\times10^{9}\Omega$

Problem 29:EE Board October 1992

The insulation resistance of a kilometer of the cable having a diameter of 2 cm and an insulation thickness of 2 cm is 600 ohms. If the thickness of the insulation is increased to 3 cm, find the insulation resistance of the cable.

A. 725 ohms B. 850 ohms C. 757 ohms D. 828 ohms

Problem 30:

The resistance of 120 meters of wire is 12 ohms. What is its conductance?

A. 0.0521 mho B. 0.083 mho C. 6 mhos D. 12 mhos

TEST 2 – DC Electric Circuits

Problem 31:

A load of 10 ohms was connected to a 12- volt battery. The current drawn was 1.18 amperes. What is the internal resistance of the battery?

A. 0.35 ohm B. 0.20 ohm C. 0.25 ohm D. 0.30 ohm

Problem 32:

The potential at the terminals of the battery falls from 9 V on open circuit to 6 volts when a resistor of 10 ohms is connected across its terminals. What is the internal resistance of the battery?

A. 5Ω B. 4Ω C. 3Ω D. 2Ω

Problem 33:EE Board April 1997

The electromotive force of a standard cell is measured with a potentiometer that gives a reading of 1.3562 V. When a 1.0 megaohm resistor is connected across the standard cell terminals, the potentiometer reading drops to 1.3560 V. What is the internal resistance of the standard cell?

A. 174.5 ohms B. 145.7 ohms C. 147.5 ohms D. 157.4 ohms

Problem 34:

A battery is formed of five cells joined in series. When the external resistance is 4 ohms, the current is 1.5 A and when the external resistance is 9 ohms, the current falls to 0.75 A. Find the internal resistance of each cell.

A. 0.5 ohm B. 1.0 ohm C. 0.2 ohm D. 0.3 ohm

Problem 35:EE Board April 1998

A Barangay power station supplies 60 kW to a load over 2,500 ft, 100mm^2, two conductors copper feeder, the resistance of which is 0.078 ohm per 1000 ft. The bus bar voltage is maintained constant at 600 V. Determine the load current.

A. 105 A B. 108 A ` C. 110 A D. 102 A

Problem 36:

A 120 V DC motor draws current of 100 A and is located 1000 ft from the supply source. If the diameter of the copper transmission line is 0.45 inch, what must be the voltage of the supply?

A. 125.32 V B. 130.24 V C. 129.32 V D. 127.05 v

Problem 37:EE Board October 1986

A LRT car, 5 km distance from the Tayuman, takes 100 A over a 100 mm hard drawn copper trolley wire having a resistance of 0.270 ohm per km. The rail and ground return has a resistance of 0.06 ohm per km. If the station voltage is 750 V, what is the voltage of the car?

A. 585 V B. 590 V C. 585 V D. 590 V

Problem 38:

The hot resistance of an incandescent lamp is 10 ohms and the rated voltage is 50 V. Find the series resistance required to operate the lamp from an 80 V supply.

A. 8Ω B. 4Ω C. 6Ω D. 10Ω

Problem 39:

A resistive coil draws 2 A at 110 V after operating for a long time. If the temperature rise is 55 °C above the ambient temperature of 20 °C, calculate the external resistance which must be initially connected in series with the coil to limit the current to 2 A. The temperature coefficient of the material of the coil is 0.0043 per °C at 20 °C.

A. 10.2 ohms B. 10.52 ohms C. 11.45 ohms D. 12.05 ohms

Problem 40:

A carbon resistor dissipates 60 W of power from a 120 V source at 20 °C. How much power will be dissipated in the resistor at 120 °C if connected across the same source? Assume the temperature coefficient of carbon at 20 °C is –0.0005 per °C.

A. 61.50 W B. 65.21 W C. 62 34 W D. 63.16 W

Problem 41:EE Board April 1981, EE Board October 1984

Two (2) 115-V incandescent lamps A and B are connected in series across a 230-V source. If lamp A is rated 75 watts and lamp B is rated 50 watts, determine the current drawn by the series connection.

A. 0.52 A B. 0.64 A C. 0.48 A D. 0.57

Problem 42:

An arc lamp takes 10 A at 50 volts. A resistance R is to be place in series so that the lamp may burn correctly from a 110 V supply. Find the power wasted in this resistor.

A. 800 watts B. 600 watts C. 700 watts D. 900 watts

Problem 43:

Conductor “x” of a certain material and a given cross section has a resistance of 0.1 ohm per meter and a temperature coefficient of 0.005 per °C. Conductor “y” of another material and a given cross section has a resistance of 0.5 ohms per meter and a temperature coefficient of 0.001 per °C. Is desired to make a coil having a resistance of 500 ohms and a temperature coefficient of 0.002 by using suitable lengths of the two wires connected in series. Calculate the required length of wire “x”.

A. 1225 m B. 1250 m C. 1240 m D. 1210 m

Problem 44:EE Board April 1997

If a resistor rated at 5 watts and 6 volts are connected across a battery with an open circuit voltage of 6 volts. What is the internal resistance of the battery if the resulting current is 0.8 A?

A. 0.30 ohm B. 0.26 ohm C. 0.23 ohm D. 0.03 ohm

Problem 45:

A high voltage DC transmission line delivers 1000 MW at 500 kV to an aggregate load over a distance of 900 km. Determine the voltage at the sending end. Assume the loop resistance of the line to be 1 mΩ per km.

A. 510.5 kV B. 505.2 kV C. 507.7 kV D. 503.6 kV

Problem 46:EE Board April 1989

It is required that a loading of 3 kW be maintained in a heating element at an initial temperature of 20 °C, a voltage of 220 V is necessary for the purpose. After the element has settled down to steady state, it is found that a voltage of 240 volts is necessary to maintain the 3 kW loading. The element resistance temperature coefficient is 0.0006 per degree centigrade at 20 °C. Calculate the final temperature of the heating element.

A. 345.43 °C B. 326.42 °C C. 336.84 °C D. 318.48 °C

Problem 47:

A 200-W, 110-V incandescent lamp has a filament having a temperature coefficient of resistance equal to 0.005 at 0 °C. If the normal operating temperature of the bulb is 2500 °C, how much current will the bulb draw at the instant it is turned on. Assume a room temperature of 20 °C.

A. 29.42 A B. 18.37 A C. 22.31 A D. 28.21 A

Problem 48:

The power drawn by a resistive coil made of copper wire is 220 W at 100 V and 20 °C. Calculate the power consume by the coil at 115 V and 100 °C. The temperature coefficient of resistance at 20 °C is 0.00393.

A. 175 W B. 211 W C. 183 W D. 225 W

Problem 49:

An electric water heater has a rating of 1 kW, 230 V. The coil used as the heating element is 10 m long and has a resistivity of 1.724×10^{-6} ohm-cm. Determine the required diameter of the wire in mils?

A. 2.43 mils B. 2.52 mils C. 3.21 mils D. 1.35 mils

Problem 50:

When two resistors A and B are connected in series, the total resistance is 36 ohms. When connected in parallel, the total resistance is 8 ohms. What is the ratio of the resistance R_a to resistance R_b. Assume $R_a < R_b$.

A. 0.5 B. 0.4 C. 0.8 D. 0.6

Problem 51:EE Board March 1998

Three resistors of 10, 15 and 20 ohms are connected in parallel. What is the equivalent resistance?

A. 45 ohms B. 17.2 ohms C. 0.22 ohms D. 4.62 ohms

Problem 52:

The equivalent resistance of three resistors A, b and C connected in parallel is 1.714 ohms. If A is twice of B and C is half as much as B, find the equivalent resistance when the three of them are connected in series.

A. 17.5 ohms
B. 21.0 ohms
C. 24.5 ohms
D. 28.0 ohms

Problem 53:

Three resistors of 10, 12 and 15 ohms are connected in parallel. Evaluate the value of current to the parallel system that will make the current in the 10 ohm resistor equal to 2 A.

A. 5 A
B. 6 A
C. 4 A
D. None of these

Problem 54:

Three resistors of 10, 12 and “x” ohms, respectively are connected in parallel across a constant current source of 8 A. Determine “x” if this resistor draws 2.5 A.

A. 10 Ω
B. 12 Ω
C. 13 Ω
D. 11 Ω

Problem 55:

Two resistors A and B made of different materials have temperature coefficients of resistance at 20° C of 0.004 and 0.006 respectively. When connected across a voltage source at 20° C, they draw current equally. What percentage of the total current at 100° C does resistor A carry?

A. 47.14 %
B. 52.86 %
C. 61.34 %
D. 38.66 %

Problem 56:

Two resistors A and B made of different materials have temperature coefficients of resistance of 0.003 and 0.005, respectively. When connected in parallel across a voltage source at 15° C, it consumes equal power. What is the ratio of the power drawn by resistor B to that in resistor A when temperature rises to 60° C? Assume supply voltage is constant.

A. 0.829
B. 0.926
C. 0.964
D. 0.882

Problem 57: EE Board March 1998

Three resistors of 10, 15 and 20 ohms each are connected in parallel. What is the total conductance?

A. 0.217 mho
B. 3.41 mhos
C. 4.62 mhos
D. 0.52 mho

Problem 58:

Two heating units x and y are connected across a 100 V supply. Unit y takes twice as much power as unit x. Total power supplied by the source is 2280 watts. Determine the total power drawn by the heating units if they are connected in series across the same source.

A. 615.32 W
B. 506.58 W
C. 582.45 W
D. 604.38 W

Problem 59:

Three resistors R_1, R_2 and R_3 are connected in series- parallel with R_1 in series with the parallel combination of R_2 and R_3. The whole combination is connected a 120 V DC source. Resistors R_1, R_2 and R_3 take 750 W, 250 W and 200 W, respectively calculate the resistance R_2.

A. 8.10 Ω
B. 8.52 Ω

C. 7.84 Ω
D. 9.22 Ω

Problem 60:

Two lamps X and Y are connected in series. Lamp X is rated 50 W at 100 V while lamp Y is rated 100 W at 100 V also. The two lamps are to be connected in series across a 200 V source. What resistance must be connected across lamp A so that each lamp will operate properly?

A. 150 ohms
B. 100 ohms
C. 200 ohms
D. 180 ohms

Problem 61: EE Board October 1997

A 5- ohm resistance is connected in parallel with 10- ohm resistance. Another set, a 6- ohm and an 8- ohm resistances are also connected in parallel. The two sets are connected in series. What is the equivalent resistance?

A. 6.76 ohms
B. 9.25 ohms
C. 14.4 ohms
D. 21.2 ohms

Problem 62:

Two resistances of 10 and 15 ohms each respectively are connected in parallel. The two are then connected in series with a 5- ohm resistance. What is the equivalent resistance?

A. 11 ohms
B. 12 ohms
C. 10 ohms
D. 9 ohms

Problem 63:

From the circuit as shown, determine the resistance between terminals a & b.

Problem 64: EE Board October 1997

A 10- ohm and 220- ohm resistance are connected in parallel. Another resistance of 5- ohm is connected in series with the two. If the supply voltage is 48 volts, what is the current through the 10- ohm resistance?

A. 3.21 A
B. 2.74 A
C. 4.02 A
D. 5.72 A

Problem 65:

A 30- ohm resistor is connected in parallel with a variable resistance R. The parallel combination is then connected in series with a 6- ohm resistor and connected across a 120 V source. Find the minimum value of R if the power taken by R is equal to the power taken by the 6- ohm resistor.

A. 10.35 Ω
B. 12.24 Ω

C. 10.24 Ω
D. 11.46 Ω

Problem 66: EE Board March 1998

Two resistance of 10 and 15 0hms, each respectively are connected in parallel. The two are then connected in series with a 5-ohm resistance. It is then connected across a 12- V battery, what are the current and power?

A. 1.2 A, 17.8 W B. 0.96 A, 11.52 W
C. 1.09 A, 13.1 W D. 1.5 A, 20.25 W

Problem 67:

An 8- ohm resistor is connected in series with a parallel combination of two resistors, R and 24 0hms. Determine R if the power consumed by the parallel- connected resistors is equal to the power consumed by the 8-ohm resistor.

A. 10 ohms B. 16 ohms C. 12 ohms D. 20 ohms

Problem 68:

A multi- tap resistor R is connected across a 220-V supply. A voltmeter whose internal resistance is 15-kΩ is connected across the center tap and one end of the supply terminals. If the voltmeter registers 100 V, what is the value of resistor R?

A. 5.5 kΩ B. 5.0 kΩ C. 6.0 kΩ D. 6.5 kΩ

Problem 69:

A potential divider of resistance of 50 ohms is connected across a 100 V DC source. A load resistance of 10 ohms is connected across a tap in the potential divider and the negative terminal of the source. If a current of 4 A flows towards the load, what is the current supplied by the source?

A. 5.32 A B. 5.05 A C. 5.21 A D. 5.48 A

Problem 70:

Two resistors A and B are connected in series across a 220 V DC source. When a voltmeter with an internal resistance o9f 10 kΩ ohms, is connected across resistor A, the instrument reads 100 V and when connected across resistor B, it reads 80 volts. Find the resistance of resistor A.

A. 4 kΩ B. 3 kΩ C. 5 kΩ D. 6 kΩ

Problem 71: EE Board April 1992

An electric kettle was marked 500 W, 230 V found to take 15 minutes to bring 1 kilogram of water at 15° C to boiling point. Determine the heat efficiency of the kettle.

A. 79.1% B. 75.3% C. 72.4% D. 74.8%

Problem 72: EE Board October 1997

A process equipment contains 100 gallons of water at 25° C. It is required to bring it to boiling in 10 minutes. The heat loss is estimated to be 5%. What is the kW rating of the heater?

A. 125 kW B. 252 kW
C. 50.5 kW D. 207 kW

Problem 73: EE Board October 1989

A total of 0.8 kg of water at 20° C is placed in a 1- kW electric kettle. How long a time in minute is needed to race the temperature of the water to 100° C?

A. 4.46 min. B. 5.32 min.
C. 6.34 min. D. 4.56 min.

Problem 74: EE Board October 1998

How many calories does an electric heater of 100 watts generate per second?

A. 10 B. 23.88 C. 1000 D. 42.25

Problem 75: EE Board 1997

The electric energy required to raise the temperature of water in a pool is 1000 kWh. If the heat losses are 25%, the heating energy required will be?

A. 1111 kWh B. 1266 kWh
C. 1750 kWh D. 1333 kWh

Problem 76: EE Board April 1992

An electric heater carries a 12 A at 110 V, submerged at 22.5 lbs of water for 30 minutes. What will be the final temperature of the water if its initial temperature is 35° F?

A. 135.43 ° F B. 125.42 ° F
C. 133.56 ° F D. 128.33 ° F

Problem 77: EE Board October 1990

In an electric heater the inlet temperature is 15° C. Water is flowing at the rate of 300 grams per minute. The voltmeter measuring across the heating element reads 120 volts and an ammeter measuring current taken reads 10 amperes. When steady state is finally reached, what is the final reading of the outlet thermometer?

A. 57.6° C B. 68.4° C
C. 72.6° C D. 42.6° C

Problem 78: EE Board October 1991

Four cubic meters of water is to be heated by means of four 1.5 kW, 230- V immersion heating elements. Assuming the efficiency of the heater is 90%, determine the time required boiling the water if the initial temperature is 20° C and if all four elements are connected in parallel.

A. 71 hrs B. 63 hrs C. 69 hrs D. 66 hrs

Problem 79: EE Board October 1991

Four cubic meters of water is to be heated by means of four 1.5 kW, 230-V immersion heating elements. Assuming the efficiency of the heater as 90%, determine the time required boiling the water if the initial temperature is 20 °C and if the elements are connected two series in parallel with two in series.

A. 275.6 hrs. B. 295.3 hrs C. 252.2 hrs. D. 264.4 hrs.

Problem 80:EE Board April 1997

A circuit consisting of three resistors rated: 10 ohms, 15 ohms and 20 ohms are connected in delta. What would be the resistance of the equivalent wye connected load?

A. 0.30, 0.32 and 0.15 ohm B. 3.0, 4.0 and 5.0 ohms C. 3.33,4.44 and 6.66
D. 5.77, 8.66 and 11.55 ohms

Problem 81:

The equivalent wye element of 3 equal resistors each equal to R and connected in delta is

A. R B. 3/2 R C. R/3 D. 3R

Problem 82:

Three resistors of 6-ohm resistance are connected in delta. Inside the delta another three 6-ohm resistors are connected in wye. Find its resistance between any two corners.

A. 2 ohms B. 3 ohms C. 4 ohms D. 1 ohm

TEST 3 – Network Laws and Theorems

Problem 82:EE Board October 1998

A 12 V battery of 0.05-ohm resistance and another battery of 12 V and 0.075 ohm resistance supply power to a 2-ohm resistor. What is the current through the load?

A. 5.85 A B. 5.63 A C. 5.72 A D. 5.91 A

Problem 84:

Two equal resistance are connected in parallel across a 150 V DC source. What potential difference exists between the midpoint of one resistance and a point that is one-third from either end of the other resistance.

A. 24 V B. 28 V C. 25 V Dd. 30 V

Problem 85:EE Board April 1989

The LRT trolley system 10 miles long is fed by two substations that generate 600 volts and 560 volts, respectively. The resistance of the trolley wire and rail return is 0.3 ohm per mile. If the car is located 4 miles from the 600- volt station draws 200 A from the line. How much is the current supplied by each station?

A. 133.33 A, 66.67 A B. 123.67 A, 76.33 A C. 117.44 A
D. 125.54 A, 63.05 A

Problem 86:

Ten cells of emf 1.5 volts and internal resistance of 0.2 ohm are joined in parallel and connected to an external circuit resistance of 3 ohms. What current the load draws?

A. 0.45 A B. 0.65 A C. 0.50 A D. 0.48 A

Problem 87:

Two batteries A and B are connected across each other with terminals of the same polarity together. The open circuit emf and internal resistance of each battery is respectively 24 V and 1.5Ω. Determine the resistance of a heating load connected across the parallel combination of batteries so that the power consumed in the load is 100 watts.

A. 4.16Ω B. 4.22Ω C. 4.02Ω D. 4.12Ω

Problem 88:EE Board October 1996

The lead storage batteries “A” and “B” are connected in parallel. “A” has an open circuit voltage of 12 V and an internal resistance of 0.2 ohm. Battery “B” has an open circuit voltage of 12.2 V and an internal resistance of 0.3 ohm. If the two batteries together delivers power to a 0.5 ohm power resistor. Neglecting effects of temperature, how much current is contributed by battery “A”?

A. 29.62 A B. 16.00 A C. 12.85 A D. 25.24 A

Problem 89:

Three resistors of 2-ohm resistance are connected in delta. Inside the delta another three 2-ohm resistors are connected in wye. Six batteries of negligible internal resistance and of different emf are inserted into each branch. Using an ammeter, the current in one of the delta branch was found out to be 3 A. If a 4-ohm resistance is inserted into that branch , what will be the new current?

A. 2.00 A B. 1.75 A C. 1.50 A D. 1.25 A

Problem 90:EE Board April 1992

In Manila, the LRT runs between Gil Puyat Station and Tayuman Station, which is 4 km apart and maintains voltages of 420 volts and 410 volts respectively. Then resistance of go and return is 0.05 ohm per km. The train draws a constant current of 300 A while in motion. What are the currents supplied by the two stations if the train is at the distance of minimum potential?

A. 175 A, 125 A B. 183 A, 117 A C. 164 A, 136 A D. 172 A, 128 A

Problem 91:EE Board October 1986

A LRT car, 5 km distance from the Tayuman, takes 100 A over a 100 mm hard drawn copper trolley wire having a resistance of 0.270 ohm per km. The rail and ground return has a resistance of 0.06 ohm per km. If the station voltage is 750 V, what is the efficiency of transmission?

A. 78% B. 81% C. 74% D. 79%

Problem 92:

A resistance R is connected across two batteries A and B connected in parallel. The open circuit emfs and internal resistance of the batteries are 12 V, 2 ohms and 8 V, 1 ohm, respectively. Determine the ohmic value of R if the power absorbed by R is 7.656 watts.

A. 10Ω B. 12Ω C. 9Ω D. 8Ω

Problem 93:EE Board October 1981

A charger, a battery and a load are connected in parallel. The voltage across the charger is 12.5 volts and the battery has an emf of 12 volts and internal resistance of 0.1 ohm. The load consists of a 2 ohms resistor. Find the current through the charger.

A. 6.61 A B. 6.25 A C. 6.42 A D. 6.50 A

Problem 94:EE Board October 1996

A lead storage battery is rated at 12 volts. If the internal is 0.01 ohm, what is the maximum power that can be delivered to the load?

A. 1,200 W B. 3,600 W C. 7,200 W D. 1,800 W

Problem 95:EE Board April 1995

A 120-V battery having an internal resistance of 0.5 ohm, is connected through a line resistance of 9.5 ohms to a variable load resistor. What maximum power will the battery deliver to the load resistor?

A. 36 watts B. 63 watts C. 630 watts D. 360 watts

Problem 96:

Two resistors x and y are connected in parallel. Resistor x having a value of 6 ohms while resistor y being adjustable over a wide range. The parallel combination is then connected through a 2- ohm line resistor to a 120 V DC source. For what resistance y will its power be the greatest?

A. 8.0 Ω B. 1.5 Ω C. 2.0 Ω D. 1.8 Ω

Problem97: EE Board April 1988

A barangay power station supplies 60 kW to a load over 2, 500 ft, 100 mm^2, two conductor copper feeder, the resistance of which is 0.078 ohm per 1000 ft. The bus bar voltage is maintained constant at 600 V. Determine the maximum power which can be transmitted.

A. 230.77 kW B. 220.35 kW
C. 242.73 kW D. 223.94 kW

Problem 98:

A variable resistor R is connected in parallel with a fixed resistor of 1.25 ohms. The combination is then connected across a 12 V battery with internal resistance 0.25 ohm. Solve for the maximum power that can be delivered to resistor R.

A. 130.20 W B. 115.52 W
C. 120.21 W D. 142.42 W

Problem 99: EE Board April 1991

Twelve similar wires each of resistance 2 ohms are connected so as to form a cube. Find the resistance between the two diagonally opposite corners.

A. 1.45 ohms B. 1.66 ohms
C. 2.01 ohms D. 1.28 ohms

Problem 100: EE Board April 1991

Twelve similar wires each of resistance 2 ohms are connected so as to form a cube. Find the resistance between the two corners of the same edge.

A. 1.133 Ω B. 1.102 Ω
C. 1.125 Ω D. 1.167 Ω

Problem 101: EE Board October 1991

Twelve identical wires of resistance 6 ohms each are arranged to form the edge of a cube. A current of 40 mA is led into a cube at one corner and out the other diagonally opposite corner. Calculate the potential difference developed between these corners.

A. 0.20 V B. 0.28 V C. 0.22 V D. 0.24 V

Problem 102: EE Board August 1976

Find the value of the voltage V.

A. 12.34 V B. 11.24 V
C. 12.19 V D. 11.66 V

Problem 103: EE Board April 1982

Referring to the circuit diagram below, if the charger voltage is 130 volts and the battery voltage is 120 volts, solve for the current I_b.

A. -0.215 A
B. 0.215 A
C. –0.306 A
D. 0.306 A

Problem 104: EE Board August 1977

In the figure below R_1 = 1 ohm, R_2 = 1 ohm, R_3 = 3 ohms, l_2= 2 A and V_B= 120 V. Find E_g.

A. 182.41 V
B. 153.32 V
C. 164.67 V
D. 157.22 V

Problem 105: EE Board October 1980, EE Board April 1984

In the dc circuit as shown, the high resistance voltmeter gives a reading of +0.435 volt. What is the value of the resistance R?

A. 4 ohms
B. 5 ohms
C. 3 ohms
D. 2 ohms

Problem 106: EE Board April 1980

Determine I in the figure.

A. 0.028 A
B. 0.010 A
C. 0.025 A
D. 0.014 A

Problem 107:

Solve for l using Source transformation method.

A. 0.32 A
B. 0.25 A
C. 0.38 A
D. 0.27 A

Problem 108:

Solve for V using Maxwell’s mesh method.

A. 4.0 V C. 2.6 V

B. 5.2 V D. 3.4 V

Problem 109:

Determine the current in the 1- ohm resistor using Norton's theorem

A. 1.54 A
B. 1.25 A
C. 1.60 A
D. 1.33 A

Problem 110:

Determine the current in the 10- ohm resistor using Thevenin's theorem.

A. 0.833 A
B. 0.667 A
C. 0.707 A
D. 0.508 A

Problem 111:

Determine the current in the 6- ohm resistor by Superposition theorem.

A. 3.4 A
B. 4.2 A
C. 4.0 A
D. 3.8 A

Problem 112:

Determine the looking back resistance between terminals a & b.

A. 11 Ω
B. 9 Ω
C. 10 Ω
D. 12 Ω

Problem 113:

Determine l.

A. 4.50 A
B. 4.28 A
C. 5.34 A
D. 3.75 A

Problem 114:

Determine the voltage V.

A. 14 V
B. 12 V
C. 10 V
D. 16 V

TEST 4 - Electrostatics

Problem 115: EE Board March 1998

Three equal positive charges of 10 statcoulomb each are located at the vertices of an equilateral triangle of 2 cm leg. What is the magnitude of the force acting on each charge?

A. 12.5 dynes B. 25 dynes
C. 43.3 dynes D. 50 dynes

Problem 116: EE Board October 1997

Two point charges 10 cm apart exert a force of 1 x 10 raised to the (-3) grams on each other. If the charges are the same value, what is the value of each charge in statcoulomb?

A. 8.90 stat coulomb B. 9.90 stat coulomb
B. 6.90 stat coulomb D. 7.90 stat coulomb

Problem 117: EE Board April 1997

Two electrons in a vacuum experience a force of 2×10^{-15} N. How far apart are the electrons?

A. 0.48×10^{-7} m B. 2.84×10^{-12} m
C. 3.39×10^{-7} m D. 5.05×10^{-12} m

Problem 118:

Two point charges of 2 C and 5 C are 10 meters apart. A third point charge of 6 C is placed between them. At what distance from the 5 C charge must the 6 C charge is placed, in such a way that it will stay in equilibrium?

A. 6.125 m B. 5.365 m
C. 6.025 m D. 5.256 m

Problem 119: EE Board October 1996

Two spheres separated from each other by 10 m have charges of 0.001 coulomb and 0.003 coulomb respectively. In between the two spheres is a point of zero electric field. What is the distance from the 0.001 coulomb sphere?

A. 6.34 m B. 7.78 m
C. 2.24 m D. 3.66 M

Problem 120:

Calculate the magnitude of the electric field at a point that is 30 cm from a point charge $Q = -3.2 \times 10^{-6}$ C.

A. 3.2×10^{6} N/C B. 3.0×10^{5} N/C
C. 2.8×10^{6} N/C D. 2.4×10^{5} N/C

Problem 121: EE Board October 1998

Two metallic plates separated by 1 cm are connected across a 12 V battery. A certain plastic material is inserted completely filling the space between the plates and the charge on each plate observed to double. What is the dielectric constant of the plastic material?

A. 0.5 B. 2 C. 4 D. 6

Problem 122: EE Board October 1991

Calculate the capacitance between two parallel plates of which is 100 cm^2 and 2 mm apart in air.

A. 0.443 μμF B. 0.515 μμF
C. 0.452 μμF D. 0.502 μμF

Problem 123:

A capacitor has two parallel metal plates measuring 0.45 m square each. The distance between the plates is 1 cm in free air. If a dielectric material whose permittivity is 4 and 5 mm thick is placed in the upper plate, leaving an air gap between the bottom plate and the dielectric, what is the capacitance of the capacitor?

A. 207 μμF B. 254 μμF
C. 193 μμF D. 287 μμF

Problem 124:

A capacitor is composed of two plates separated by a 3-mm insulation whose dielectric constant is 4. An additional piece of 6-mm insulation is inserted between the plates. What is the dielectric constant of the additional insulation if the capacitance of the capacitor decreases to half as much of its original value?

A. 5 B. 8 C. 6 D. 6

Problem 125:

A parallel- plate capacitor has an equivalent capacitance of 850 pF. The area of each plate is 6 cm^2 and the thickness of the dielectric is 0.02 cm. If the material used as the dielectric has a constant of 8, how many sections are there in parallel?

A. 4 B. 5 C.7 D. 6

Problem 126: EE Board October 1994

A parallel plate capacitor is made of 350 plates, separated by paraffined paper 0.0010 cm thick (k= 2.5). The effective size of a plate is 15 by 30 cm. What is the capacitance of the capacitor?

A. 35 μF B. 15 μF C. 140 μF D. 70 μF

Problem 127: EE Board October 1997

A capacitor is charged with 0.23 watt- second of energy at a voltage of 48 volts. What is its capacitance?

A. 180 μF B. 240 μF
C. 200 μF D. 220 μF

Problem 128: EE Board October 1997

A 20- μF capacitor is charged by a 12- V battery. What is the stored energy in the capacitor?

A. 1.07×10^{-3} J B. 2.88×10^{-2} J
C. 2.88×10^{-3} J D. 1.44×10^{-3} J

Problem 129: EE Board October 1994

A parallel plate capacitor with air between its plate is charged until the potential difference V appears across it. Another capacitor having a hard rubber (dielectric constant = 3) between its plates but otherwise identical, is also charged to the same potential difference. If the energy of the first capacitor is W, that of the second is

A. 9W B. W/3 C. W D. 3 W

Problem 130:

A capacitor whose plates is 20 cm x 3.0 cm and is separated by a 1.0- mm air gap is connected across a 12- V battery. Determine the charge accumulated on each plate after a long time.

A. 5.3×10^{-12} C B. 7.2×10^{-9} C
C. 8.1×10^{-11} C D. 6.4×10^{-10} C

Problem 131: EE Board October 1990

The result of capacitance C_1 = 6 microfarads and C_2 connected in series is 3 microfarads. Capacitor C_2 in microfarads is

A. 3 B. 4 C. 8 D. 6

Problem 132:

The equivalent capacitance of two capacitors in series is 0.03 μF and when connected in parallel, 0.16 μF. If the capacitor with smaller capacitance is replaced with a capacitor whose capacitance is double as much what will be the new equivalent series capacitance of the combination.

A. 0.048 μF B. 0.005 μF
C. 0.042 μF D. 0.050 μF

Problem 133:

Three capacitors of 16, 15 and 12 μF respectively are connected in series. What is the maximum voltage that can be supplied to the combination if the voltage drop across any of the three capacitors must not to exceed 100 V.

A, 260 V B. 245 V C. 255 V D. 250 V

Problem 134:

Three capacitors of 20, 10 and 15 μF respectively are connected in series across a 100 V supply. Find the voltage across the 10 μF capacitor.

A. 54.52 V B. 46.15 V

C. 38.25 V D. 42.38 V

Problem 135:

Three condensers of 6, 10 and 15 μF are connected in series across a 200 V supply. If the condensers are disconnected, how much energy can the charged condenser provide if connected across each other with like polarities together?

A. 0.052 J B. 0.060 J
C. 0.076 J D. 0.068 J

Problem 136:

Two capacitors with capacitance of 6 μF and 4 μF are connected in series across a 100 V dc source. If the supply voltage is cut- off and the two capacitors are connected in parallel, what will be the final charge accumulated in the 4 μF capacitor?

A. 96 μC B. 192 μC
C. 126 μC D. 88 μC

Problem 137:

A 40 μF capacitor is charged to store 0.2 J of energy. An uncharged 60 μF capacitor is connected in parallel with the first one through a perfectly conducting leads. What is the energy lost due to the work done by the charges in spreading out over the two capacitors?

A. 0.08 J B. 0.12 J C. 0.80 J D. 0.012 J

Problem 138:

Four capacitors A, B, C and Dare connected across a 150-V DC source. The charges accumulated in A, B and C are equal to 2000, 750 and 1500 μC, respectively. If the total capacitance of the combination is known to be 35 μF, how much charged is the accumulated in capacitor D?

A. 1200 μC B. 1000 μC
C. 1150 μC D. 1400 μC

Problem 139: EE Board October 1993

A condenser of 1 microfarad capacitance is charge to 100 volts and then disconnected from the power supply. A second but uncharged capacitor of 3 microfarad is then connected across the first capacitor. The voltage across the parallel combination is

A. 66 2/3 volts B. 45 volts
C. 25 Volts D. 110 volts

Problem 140: EE Board October 1994

Three capacitors A, B and C are charged as follows: A= 10 μF, 100 V; B= 15 μF, 150 V and C= 25 μF, 200 V. they are connected in parallel with terminals of like polarity together. What is the voltage across the combination?

A. 150 A B. 120 V C. 185 V D. 165 V

Problem 141:

A 100 μF capacitor is charged from a 200- V supply. The charged capacitor is then connected across three uncharged capacitors connected in parallel. The charges on these capacitors after a long time become 4000, 5000 and 6000 μC. Solve the voltage across the combination.

A. 64 V B. 50 V C. 76 V D. 80 V

Problem 142:

Two capacitors of 200 and 800 nF, respectively are connected in parallel. The combination is then connected in series with another two capacitors of C and 600 nF connected in parallel. If the total capacitance of the set- up is 500n nF, determine the capacitance C.

A. 650 nF B. 550 nF
C. 400 nF D. 500 nF

Problem 143:EE Board April 1997

A coaxial cable has a 10-mm diameter inside conductor and a metallic sheath with an inside diameter of 20 mm. If the insulating medium has a dielectric constant, k= 2, and a permittivity of 1.113×10^{-10}, what is the capacitance between the conductor and the shield per km?

A. 0.1605 μF/km
B. 0.8036 μF/km
C. 0.0803 μF/km
D. 0.0403 μF/km

Problem 144:EE Board October 1994

A lead-sheath cable for underground service has a copper conductor (diameter=0.350 inch) surrounded by 0.20-inch wall of rubber insulation. Assuming the dielectric constant of 4.3 for rubber, calculate the capacitance of the cable per mile length.

A. 1.01 μF/mile
B. 0.504 μF/mile
C. 0.76 μF/mile
D. 0.252 μ/mile

TEST 5 – Magnetic Circuits

Problem 145:EE Board October 1994

The force acting on a pole of 3 Wb is 12 N. The magnetic intensity of the magnetic field is

A. 4 N per Wb B. 12 N per Wb C. 36 N per Wb D. none 0f these

Problem 146:

Two straight parallel wires 2 m long and 3 mm apart carries a current of 8.0 A in opposite direction. Calculate the force between these conductors.

A. 8.33×10^{-3} N
B. 8.25×10^{-3} N
C. 8.53×10^{-3} N
E. 8.75×10^{-3} N

Problem 147:

A wire 12 cm long and carrying a current of 30 A is placed in between the pole face of a magnet whose magnetic flux density is 0.9 tesla. If the wire is inclined at an angle 60 degrees from the plane of the magnetic field, what is the force exerted on the wire?

A. 2.8 N B. 2.5 N C. 3.1 N D. 2.2 N

Problem 148:EE Board October 1992

The reluctance of a non-magnetic circuit is 12 units. How much flux will be set up if surrounded by a coil 600 turns carrying a current of 3 A.

A. 150 B. 16.67 C. 50 D. 200

Problem 149:

The coil in a magnetic contactor requires 0.5 A to provide a magnetizing force of 500 AT. How many turns are necessary?

A. 250 B. 500 C. 1000 D. 2000

Problem 150:

A solenoid 30-cm long is wound with 300 turns, what is the value of its field strength inside the solenoid, when the coil is carrying a current of 2 amperes?

A. 1500 AT/m B. 2000 AT/m C. 1800 AT/m D. None of these

Problem 151:

Calculate the magnetic field intensity to produce a flux density of 10×10^{-3} tesla at the center of a long straight solenoid.

A. 7958 AT/m B. 6423 AT/m C. 8323 AT/m D. 7869 AT/m

Problem 152:EE Board October 1996

If a current of 5 A flows through a long wire radius 0.004 meter, what is the flux density (H) produced 0.02 meter away from the surface of the wire.

A. 19.70 AT/m B. 39.80 AT/m C. 66.34 AT/m D. 33.17 AT/m

Problem 153:EE Board October 1997, EE Board October 1998

The relative permeability of a certain silicon steel is 4500. A certain magnetic loop consists of a silicon steel of 10 cm square, 20 cm long and an air gap of ¼ cm. What is the reluctance of the magnetic circuit?

A. 2.54×10^{-2} B. 6.44×10^{-3} C. 6.44×10^{-4} D. 2.54×10^{-3}

Problem 154:EE Board March 1998

A certain laminated steel core has a permeability of 3000. The length is 5 cm and the cross section is 2 sq. cm. What is its reluctance?

A. 7500 B. 8.33×10^{-4} C. 1200 D. 2.5

Problem 155:

A coil with 900 turns is wound over a magnetic core with a reluctance of 10,000 AT/Wb. If a current of 0.5 A is pass through the coil, how much is the magnetic flux that the coil generates?

A. 0.062 Wb B. 0.058 Wb C. 0.032 Wb D. 0.045 Wb

Problem 156:

An air-core circular coil has 5000 turns. The inner and outer diameters are 20 and 24 cm respectively. If a current of 2 A is passed through the coil, determine the flux density inside the coil.

A. 0.018 T B. 0.021 T C. 0.013 T D. 0.015 T

Problem 157:

A given magnetic circuit has a magnetic field intensity of 400 AT/m. If the length of the magnetic path is doubled maintaining the same magnetomotive force, how much is the new magnetic field intensity?

A. 800 AT/m B. 400 AT/m C. 200 AT/m D. 600 AT/m

Problem 158: EE Board October 1998

A magnetic circuit consists of silicon steel of 3000 permeability, of 10 cm length and a cross section of 1.5 sq. cm and an air gap of the same cross section and of 2 cm length. A ½ - ampere current flows through the 5000-turn coil. What is the field intensity at the air gap?

A. 250 oersted B. 795 oersted
C. 2262 oersted D. 1567 oersted

Problem 159: EE Board March 1998

A magnetomotive force is supplied by a current of one ampere through 100 turns. The magnetic circuit consists of a steel core of 1000 permeability, 10 cm long and 4 sq. cm area and an air gap one cm long. What is the field intensity at the air gap?

A. 12.25 oersted B. 497.66 oersted
C. 100.53 oersted D. 124.4 oersted

Problem 160:

A circular ring of iron having a cross sectional area of 5 cm^2, an average diameter of 30 cm is wound with a coil of 1000 turns. If a current of 3 A is pass through the coil, determine the flux generated? Assume the relative permittivity of iron is 250.

A. 5×10^{-4} Wb B. 6×10^{-4} Wb
C. 6.5×10^{-4} Wb D. 4.75×10^{-4} Wb

Problem 161:

A non- magnetic ring having a cross sectional area of 10 cm^2 is uniformly wound with 300 turns of a given wire. If a current of 1 A is passed through the coil, 2.4 μWb of flux is generated inside the ring. Determine the average diameter of the ring.

A. 50 cm B. 42 cm C. 48 cm D. 54 cm

Problem 162:

A coil with 150 turns is wound over a 200 cm a cylindrical iron core whose relative permittivity is 250. if a current of 2 A is pass through the coil, determine the flux density in the core.

A. 0.04 T B. 0.07 T C. 0.12 T D. 0.10 T

Problem 163: EE Board March 1998

A magnetic circuit consists of silicon steel of 3000 permeability and an air gap. The length of the steel core is 10 cm and the air gap is 2 cm. Both have the same cross section of 1.5 sq. cm. A current of ½ ampere flows through the windings to produce 2351 maxwells flux. How many turns are there in the coil?

A. 4120 turns B. 5000 turns
C. 2500 turns D. 1250 turns

Problem 164:

A toroidal core with a mean circumference of 1000 cm and a cross sectional area of 10 cm^2 is wound with 500 turns of wire. What current would be required to generate a flux of 1 mWb in the core? Assume the core has a relative permeability of 800.

A. 1.0 A B. 2.0 A C. 1.5 A D. 2.5 A

Problem 165:

A magnetic ring (relative permittivity = 800) has a mean radius of 10 cm and a cross sectional area of 5 cm^2. An air gap measuring 1.5 mm is cut in the ring. Determine the required mmF in order to produce a flux of 0.25 mWb in the air gap.

A. 890 B. 920 C. 909 D. 972

Problem 166:

A magnetic ring with a mean diameter of 25 cm and a cross sectional area of 5 cm^2 is wound with a coil of 600 turns. An air gap of 4 mm is made by cutting a section of the ring. A current of 10 A is passed through the coil. Determine the energy stored in the air gap. Assume relative permittivity of the ring to be 1000.

A. 2.08 J B. 1.96 J C. 1.57 J D. 1.66 J

Problem 167: EE Board April 1995

A permanent magnet loudspeaker is equipped with a 10 ohm 10 turn voice coil wound on a tube 1 inch in diameter. The flux density in the air gap is 10 000 lines per square inch. If the impedance of the voice coil is a pure resistance, what will be the maximum thrust delivered to the core if the impressed signal is 20 dB above 0.005 watt?

A. 0.0336 N B. 0.0116 N
C. 0.0276 N D. 0.0532 N

Problem 168: EE Board October 1997

A small single- phase transformer has 10.2 watts at no load. The core has a volume of 750 cubic cm. The maximum flux density is 10 000 gauss and the hysteresis constant of the core is 5×10^{-4}. Using the Steinmitz law to find the hysteresis, determine the eddy current loss.

A. 4.55 W B. 5.55 W
C. 3.55 W D. 2.55 W

Test 6 – Electromagnetic Induction

Problem 169: EE Board October 1998

A magnetic coil produces 100 000 maxwells with 2000 turns and with a current of 2 A. the current is cut-off and the flux collapses in 0.01 sec. What is the average voltage that will appear across the coil?

A. 20 kV B. 200 V C. 2000 kV D. 2 kV

Problem 170: EE Board October 1998

A magnet, which generates 800 maxwells of flux, is inserted through a coil of 1000 turns. It is then withdrawn within 0.15 sec. What is the voltage that appears across the coil?

A. 0.22 V B. 53.3 V C. 533 V D. 0.0533 V

Problem 171:

The armature coil of a generator with 50 conductors on it rotates in a magnetic field with a magnetic flux density 1.5 T. the effective area of the coil is 1000 square cm. If this coil is move across the pole in 0.5 sec, determine the average emf induced in the coil.

A. 20 V B. 15 V C. 10 V D. 12 V

Problem 172: EE Board April 1997

A conductor, 50 mm long, moves at a velocity of 2.5 meters per second across a magnetic field of 0.90 Wb/m^2. What is the voltage generated?

A. 0.125 V B. 0.0648 V
C. 0.1125 V D. 0.072 V

Problem 173:

An airplane travels at a speed of 1000 kph in a region where the earth's magnetic field is 5.0×10^{-5} T and is nearly vertical. What is the potential difference induced between the wing tips of the airplane, which is 20 m apart?

A. 0.28 V B. 0.23 V C. 0.36 V D. 0.15 V

Problem 174: EE Board October 1998

A piece of conductor 10 cm long moves across a magnetic field of 10, 000 gauss at a velocity of 120 cm/sec. What voltage appears across the conductor?

A. 0.24 V B. 0.12 V C. 60 V D. 120 V

Problem 175:

A conductor 50 cm in length moves at an angle of 30^o to the direction of a magnetic field with a velocity of 100 cm/s. If the field has the flux density of 2 Wb/m^2, calculate the emf induced in it.

A. 0.5 V B. 2.0 V C. 1.0 V D. 1.5 V

Problem 176:

A metal disk of 30 cm radius rotates at an angular velocity of 1200 rpm across a uniform vertical magnetic field of flux density 0.5 Wb/m^2. Calculate the voltage induced between the rim and the center of the disk.

A. 4.7 V B. 5.8 V C. 5.1 V D. 4.4 V

Problem 177:

A conducting disc 20-cm in diameter pivoted by a vertical spindle which is lying in uniform vertical magnetic field of flux density 0.3 T. A fixed brush is connected at the edge of the disc. When a 4 Ω resistance is connected across the brush and the spindle, a current of 15 mA was observed to flow through the resistor. Determine the velocity in which the disc is rotating.

A. 394 rpm B. 382 rpm
C. 302 rpm D. 228 rpm

Problem 178:

How much is the inductance of a coil that induces 500 V when the current changes at the rate of 5 mA in 2 μs?

A. 12.5 μH B. 0.2 H C. 0.1 H D. 2 mH

Problem 179:

The field windings of a DC generator is wound with 900 turns and has a resistance of 50 ohms. If the is excited from a 240 V dc source, the magnetic flux linking the coil is 4 mWb. Determine the self- inductance of the coil.

A. 0.75 H B. 0.83 H C. 0.92 H D. 0.56 H

Problem 180:

A coil of 1000 turns is uniformly wound on a ring of non- magnetic material, the mean diameter being 20 cm. The cross sectional area of the coil is 4 square cm. Determine the self- inductance of the coil.

A. 0.7 mH B. 0.9 mH
C. 0.6 mH D. 0.8 mH

Problem 181:

An iron core 0.4 m long and 5 square cm in cross section, is wound with 300 turns. When a current of 0.5 A flows in the coil, how much is the inductance of the coil. Assume the core has a permeability of 2500.

A. 0.35 H B. 0.42 H C. 0.26 H D. 0.31 H

Problem 182: EE Board October 1990

What is the coefficient of coupling of two coils whose mutual inductance is 1 H and whose self- inductance are 1.2 and 2 H?

A. 1.549 B. 2.400 C. 0.645 D. 0.912

Problem 183:

A coil of inductance 8 mH, produces 80 μWb of magnetic flux. Of this total flux, 60 μWb are linked to a second coil of inductance 2 mH, how much is the mutual inductance between coils?

A. 3 mH B. 4 mH C. 5 mH D. 2 mH

Problem 184: EE Board April 1992

The total inductance of two coils, A and B when connected in series aiding is 0.5 H and 0.2 H when connected in series opposing. Coil A when isolated from coil B has a self- inductance of 0.2 H. calculate the self-inductance if coil B.

A. 0.16 H B. 0.12 H C. 0.20 H D. 0.15 H

Problem 185:

Two identical coils with self- inductance 250 μH each are connected in series. When connected series aiding, the equivalent inductance is 550 μH and 450 μH when connected series opposing. How much is the coupling coefficient of two coils?

A. 0.2 B. 0.3 C. 0.1 D. 0.4

Problem 186:

A cylinder whose radius is 2 cm and altitude of 100 cm is uniformly wound with 2500 turns of wires in s single layer. A second layer of 100 turns and of much finer wires is wound over the first near its center. Calculate the mutual inductance of the two coils.

A. 0.40 mH B. 0.38 mH
C. 0.52 mH D. 0.63 mH

Problem 187:

Two coils having 200 and 300 turns respectively are wound side by side on a common closed core whose cross section is 100 cm^2 and mean length of 200 cm. What will be the voltage induced in the second coil if the current in the first coil changes from 0 to 5 A in 0.05 second. Assume relative permittivity of the core to be 1500.

A. 52.3 V B. 67.8 V C. 62.6 V D. 58.6 V

Problem 188: EE Board October 1996

The energy (Wo) stored in a coil is dependent in the inductance (L) of the coil and the current flowing. If the inductance were doubled with the same current flowing, what would be the resulting stored energy?

A. 2.0 Wo B. 0.5 Wo
C. 1.0 Wo D. 4.0 Wo

Problem 189: EE Board October 1990

A 6.0 H coil whose resistance is 12 ohms is connected with series with a 24 ohms resistor and to a 144 V battery and a switch. The switch is closed at t = 0. Determine the energy stored in the magnetic field at steady state.

A. 50 J B. 48 J C. 52 J D. 46 J

Problem 190:

Two coils having self- inductance and mutual inductance of 3H, 2H and 1H respectively are connected in series. If a current of 4 A is passed through the coil, evaluate the ratio of the energy stored in the magnetic field when the fluxes (self and mutual) are in the same direction to the energy stored when the said fluxes are against each other.

A. 3.24 B. 2.33 C. 1.73 D. 2.67

Problem 191: EE Board April 1995

Two coils of inductances 4 and 6 henry are connected in parallel. If their mutual inductance is 3 henry, calculate the equivalent inductance of the combination if mutual inductance assist and if mutual inductance opposes the self- inductance respectively.

A. 2.4 H & 1.4 H B. 3.75 H & 0.94 H
C. 6.25 H & 2 75 H D. 16 H & 4 H

Problem 192:

A 50- mH inductor is charged to store 1 J of energy. If an uncharged 30- mH inductor is then connected across its terminals, how much energy is transferred to the second conductor?

A. 0.154 J B. 0.262 J
C. 0.234 J D. 0.141 J

Problem 193:

A solenoid 500 cm long and 10 cm in diameter is wound with 1500 turns. Find the energy stored in the magnetic field when a current of 5 A flows.

A. 0.45 J B. 0.55 J C. 0.46 J D. 0.72 J

Problem 194:

A coil of 250 turns is wound on a closed ring iron whose cross sectional area is 20 cm^2 and mean length of 100 cm. Determine the energy stored in the magnetic field if a current of 2 A is passed through it. Assume the permeability of iron is 900.

A. 2.83 J B. 3.12 J C. 2.03 J D. 1.88 J

Test 7 - Single-Phase AC System: Part I

Problem 195: EE Board October 1996

What is the wavelength of a carrier wave with a frequency of 100 megahertz?

A. 3.0 m B. 7.5 m C. 1.5 m D. 6.0 m

Problem 196: EE Board April 1997

A chart speed of a recording instrument is 25 mm/sec. One cycle of the signal being recorded extends over 5 mm. What is the frequency of the signal?

A. 20 cps B. 2 cps C. 50 cps D. 5 cps

Problem 197: EE Board April 1990

A 240- V, 25 Hz sinusoidal generator is connected to a 20 ohms resistor. Determine the instantaneous current when elapsed time is 0.01 second.

A. 15.43 A B. 16.30 A
C. 16.97 A D. 12.00 A

Problem 198: EE Board April 1997

A wire carries a current, I = 3 cos 314t amperes. What is the average current over 6 seconds?

A. 0 A B. 1.5 A C. 3.0 A D. 0.523 A

Problem 199:

Two current sources deliver a common load. The first source delivers a current whose equation is 25 sin $100\pi t$ amperes while the second delivers a current whose equation is 15 cos $100\pi t$ amperes. What is the rms value of the current in the load?

A. 29.15 A B. 40 A C. 20.6 A D. 10 A

Problem 200:

Two alternators A and B delivers 100 and 150 A, respectively to a load. If these currents are out of phase by 30 electrical degrees, determine the total current drawn by the load.

A. 201.5 A B. 250.0 A
C. 215.4 A D. 241.8 A

Problem 201: EE Board June 1990

Three loads, units A, B and C are connected in parallel and take currents that are respectively 12, 10 and 15 A respectively. Assuming l_a to be the reference phasor. l_b leads l_a by 30^o and l_c lags behind l_a by 65^o, calculate the total (resultant) current.

A. 28.33 A B. 30.21 A C. 26.46 A D. 32.10 A

Problem 202: EE Board October 1984

An industrial coil has a resistance of 32 ohms and a reactance of 24 ohms and rated 440 volts at 60 Hz. A factory will connect the coil to a 440 V, 50 Hz supply. Solve for the value of a series resistor needed to avoid overcurrent condition.

A. 2.07 Ω B. 2.64 Ω
C. 2.44 Ω D. 2.25 Ω

Problem 203: EE Board April 1997

Across a 230 V, 60 Hz powers supply is a 15- ohm non- inductive resistor. What is the equation of the resulting current?

A. 21.68 sin 377t B. 26.55 sin 377t
C. 15.33 sin 377t D. 28.16 sin 377t

Problem 204: EE Board October 1998

Two relays each with 20 ohms resistance and 0.16 henry inductance are connected in series. What is the equivalent impedance?

A. 20 + j 102.2 ohms B. 20 +j 95.32 ohms
C. 40 + j 120.63 ohms D. 40 + 25.32 ohms

Problem 205:EE Board October 1990

An inductive coil takes a current of 2 A and consumes 160 W when connected to a 240 V AC supply. A second coil when connected across the same supply takes 3 A and 500 W. Find the total power when the two coils are connected in series to this supply.

A. 144.56 W B. 134.31 W C. 150.22 W D. 128.35 W

Problem 206:

A ½ hp, 110-V, 60 Hz, single phase induction motor has an efficiency of 88% and a power factor of 0.707 lagging at rated load. This motor is to be connected temporarily on a 220 V, 60 Hz line. Determine the resistance required to be placed in series with the motor in order to prevent the machine from experiencing overcurrent?

A. 25.2 ohms B. 23.5 ohms C. 19.5 ohms D. 27.6 ohms

Problem 207:

Two coils A and B known to have the same resistance are connected in series across a 110-V, 60-cycle line. The current and power delivered by the source are respectively 4.1 A and 300 W. If the voltage across coil A is twice that across coil B, calculate the inductance of coil B.

A. 8.63 mH B. 7.36 mH C. 9.02 mH D. 4.49 mH

Problem 208:EE Board October 1985

A coil draws 1875 watts when connected to a 150 V DC source. It consumes 3072 watts when used on 240 V, 60 Hz AC source. Find the inductance of the coil.

A. 0.0255 H B. 0.0341 H C. 0.0153 H D. 0.0240 H

Problem 209:EE Board October 1994

A current of 10 A and a power factor of 0.8 lagging is taken from a single phase 250 volt supply. The reactive power of the system is

A. 1500 B. 2000 C. 2500 D. None of these

Problem 210:EE Board October 1996

A resistor of 6 ohms and an unknown impedance coil in series draws 12 A from a 120-V, 60-Hz line. If the real power taken from the line is 1152 watts, what is the coil inductance?

A. 15.9 mH B. 10.0 mH C. 20.0 mH D. 1.59 mH

Problem 211:EE Board April 1997

Determine the power angle in the series circuit which consists of R=25 ohms, L=0.2 H across a power supply of 200 volts, 30 Hz?

A. 36.4° B. 52.4° C. 46.4° D. 56.4°

Problem 212:

When a 30 V DC source is applied to a given coil, the coil draws 150 W. When 230 V DC is applied to the same coil, it draws 3174 W. Determine the operating power factor of the coil.

A. 0.7 B. 0.6 C. 0.9 D. 0.8

Problem 213:EE Board April 1993

The impedance coil absorbs 250 watts when connected across 220 V, 60 Hz mains. It is then connected across 110 V, 25 Hz mains and also absorbs 250 watts. What is the conductance of the coil?

A. 0.125 H B. 0.149 H C. 0.154 H D. 0.163 H

Problem 214:EE Board April 1995

An impedance coil takes10 A and absorbs 250 W when connected across a 220 V, 60 Hz source. What power will it absorb when connected across 110 V, 25 Hz mains?

A. 539 W B. 239 W C. 439 W D. 339 W

Problem 215: EE Board October 1984

An industrial coil has a resistance of 32 ohms and a reactance of 24 ohms and rated 440 volts at 60 Hz. A factory will connect the coil to a 440 V, 50 Hz supply. How much percentage overcurrent will the coil suffer?

A. 5% B. 10% C. 6 % D. 8 %

Problem 216:

The open circuit voltage across the output terminals of an AC power supply is 15.2 V. When these terminals are short- circuited, a current of 3.2 A flows. When a 5- ohm resistance is placed across these terminals, the current through it is 1.8 A. Calculate the series internal resistance of the power supply.

A. 2.374 ohms B. 2.240 ohms
C. 2.125 ohms D. 2.045 ohms

Problem 217:

A single- phase load takes 55 kW at 70% pf lagging from a 240 V, 50 Hz supply. If the supply is made 60 Hz, with the voltage remaining the same, what will be the kW load at 60 Hz?

A. 42 kW B. 48 kW C. 40 kW D. 45 kW

Problem 218: EE Board March 1998

A 25- ohm resistor connected in series with a coil of 50- ohm resistance and 150 mH inductance. What is the power factor of the circuit?

A. 85 % B. 80 % C. 90 % D. 75 %

Problem 219: EE Board October 1998

The ohmic resistance of a large magnetic contractor is measured to be 20 ohms. A 230 V is impressed on the contractor and the current is taken as 3.2 A. Neglecting core loss, determine the inductance if the contractor in mH?

A. 261 B. 315 C. 183 D. 251

Problem 220:

An 8- ohm resistor is connected in series with an inductive coil and the combination is connected across a 120 V, 60 Hz source. A voltmeter connected across the resistor reads 32 V and 104 V when connected across the coil. Determine the resistance of the coil.

A. 8 Ω B. 9 Ω C. 12 Ω D. 10 Ω

Problem 221:

When connected to a 220- V, 50 Hz supply, an impedance coil circuit takes 5 A, but this current falls to 4.4 A when a 10- ohm resistor is added in series. Find the inductance of the coil.

A. 0.20 H B. 0.15 H C. 0.23 H D. 0.12 H

Problem 222:

An impedance coil, in series with a resistor takes a current of 5 A when connected to a 100- V AC source. Using a voltmeter, the voltage across the coil was found out equal to 80 V and that across the resistor equal to 30 V. Find the operating power factor of the coil.

A. 0.56 B. 0.83 C. 0.73 D. 0.62

Problem 223: EE Board March 1998

A load of 20 + j35 ohms is connected across a220 volts source. Determine the power factor and the VARS.

A. 49.6 %, 1042 VARS B. 85.3 %, 975 VARS
c. 52.2 %, 1023 VARS D. 42.3 %, 1087 VARS

Problem 224:

A load is rated at 115 V, 60 Hz, 10 A and 1150 W. A coil is to be wound with a ratio of X_L to R of 5, such that when connected in series with the load on 230- V, 60 Hz line, the load may operate normally. Solve for R.

A. 2.450 ohms B. 3.489 ohms
C. 2.215 ohms D. 3.826 ohms

Problem 225: EE Board October 1990

Find the total impedance in rectangular for the following three impedances: $12\angle 10^o$, $25\angle 15^o$ and $34\angle 26^o$

A. 66.52 + j 23.46 B. 68.34 + j 20.54
C. 74.31 + j 21.56 D. 67.70 + j 22.04

Problem 226: EE Board October 1997

An impedance draws a current I = 10 cos (wt – 30°) from a voltage, v = 220 sin (wt + 30°). What is the impedance?

A. 15.6 – j 15.6 B. 15.6 + j 15.6
C. 19.1 – j 11.1 D. 11.0 + j 19.1

Problem 227: EE Board April 1990

A series resistance- capacitance (R- C) circuit is connected to a 230 volt 60 cycle source. If the power taken by the circuit is 4, 800 watts and the voltage drop across the resistor is 115 volts, calculate the capacitance of the capacitor.

A. 540 μF B. 530 μF
C. 556 μF D. 503 μF

Problem 228: EE Board March 1998

A 500 and 100- microfarad capacitors are connected in series and across a 100 sin (wt + 30°) voltage. Write the equation of the current.

A. 1.26 sin (wt + 120°) B. 1.26 sin (wt + 90°)
C. 5.65 sin (wt +120°) D. 5.56 sin (wt + 90°)

Problem 229: EE Board October 1996

A series circuit composed of 100- ohm resistor and a 20- microfarad capacitor connected across a 240- V, 60 Hz line. Which of the following answer is WRONG?

A. The impedance of the circuit is 167 ohms
B. Angle between the current and the voltage vectors is 53.1 degrees
C. The resulting current is 0.723 ampere
D. The voltage across the resistance is 144.6 volts

Problem 230: EE Board April 1994

A capacitance is connected to a 115- V, 25- Hz mains and takes 5 A. What current will it take when the capacitance and the frequency are both doubled?

A. 2.5 A B. 5 A C. 20 A D. 10 A

Problem 231:

An ideal inductor of 50 mH is connected in series with a 175- μF capacitor. The combination is then connected across a 120- V variable frequency AC source. At what frequency will this circuit take a leading current of 5 A?

A. 25 Hz B. 30 Hz C. 28 Hz D. 22 Hz

Problem 232:

A series consisting of a variable resistor in series with a capacitance of 80 μF is connected across a 120- V, 50 Hz supply. To what value should R is adjusted so that the power absorbed by the series circuit will be 100 W?

A. 20 ohms B. 18 ohms
C. 15 ohms D. 12 ohms

Problem 233: EE Board October 1996

A capacitor is rated 100 kVAR, 380 volts, 50 Hz. What will it's rating be at 60 Hz, 220 volts?

A. 50 kVAR B. 40 kVAR

C. 90.9 kVAR D. 57.7 kVAR

Problem 234: EE Board October1992

A resistor and a capacitor are connected in series across a supply of 250 V. When the supply frequency is 50 Hz the current in the circuit is 5 A. When the supply frequency is 60 Hz, the current is 5.8 A. Find the value of the capacitance.

A. 58.3 μF B. 60.2 μF
C. 69.1 μF D. 70.2 μF

Problem 235: EE Board October 1993

A series circuit composed of a 0.2 henry inductor and 74- microfarad capacitor is connected to a 60 V variable frequency source. At what frequency is the current be 4 amperes with a lagging power factor?

A. 50 Hz B. 51 Hz C. 48 Hz D. 49 Hz

Problem 236:

A single phase lagging power factor load takes 300 W and 5A at 120 V. find the reactance of a pure capacitor that maybe placed in series with this load so that it will operate normally from a 240- V source.

A. 62.32 ohms B. 67.25 ohms
C. 68. 15 ohms D. 64.48 ohms

Problem 237:

A coil (RL) is connected in series with a capacitor across a 220 V, 60 Hz AC supply. The circuit is designed such that the voltage across the coil and the capacitor are numerically equal. If this circuit operates at 0.87 leading pf, determine the magnitude of this voltage.

A. 212 V B. 228 V C. 205 V D. 223 V

Problem 238:

A series circuit connected across a 100- V AC source consist of a 10- Ω resistor, a 5- Ω capacitor, a resistance R that takes 50 W and a reactance X taking 100 inductive VARS. Determine the minimum value of current required satisfying the above conditions.

A. 1.20 A B. 0.92 A C. 1.04 A D. 1.13 A

Problem 239: EE Board October 1998

The maximum instantaneous voltage and current outputs of an alternator are 300 V and 20 A, respectively. What is the power output in watts if the voltage leads the current by 30^{o} ?

A. 2598 B. 6000 C. 5196 D. 3000

Problem 240: EE Board October 1998

A 50- microfarad is connected with a coil having 50 ohms resistance and 150- mH inductance. The source voltage is 100 sin (wt- 30^{o}) V. What is the maximum power?

A. 199 watts B. 147 watts
C. 212 watts D. 165 watts

Problem 241: EE Board October 1997

An impedance draws a current I = 10 cos (wt- 30^{o}) from a voltage v = 220 sin wt. What is the maximum power?

A. 2200 watts B. 1100 watts
C. 190.5 watts D. 1320 watts

Problem 242: EE Board April 1995

An incandescent lamp load generally considered to be made up of resistors take 4.8 kW from a 120- V AC source. The instantaneous maximum of power is

A. 4800 W B. 2400 W
C. 480 W D. 9600 W

Test 8 - Single-Phase AC System: Part II

Problem 243: EE Board October 1981

A circuit consists of X_a = j5 ohms, X_c = -j5 ohms and R = 5 ohms all are connected in parallel. Find the equivalent impedance.

A. 5.5 Ω B. 5.0 Ω C. 4.8 Ω d. 5.2 Ω

Problem 244: EE Board October 1985

Given: Z_1 = j2.5 ohms; Z_2 = j4 ohms; Z_3 = 5 ohms; Z_4 = 1 + j5 ohms. If the four impedances are connected in parallel, find the equivalent impedance in ohms.

A. 4.1 + j0.72 B. 4.3 + j0.45
C. 4.2 + j0.35 D. 4.0 + j0.97

Problem 245: EE Board April 1984, EE Board April 1987

Three impedances Z_a = 3 + j4 ohms, Z_c = 4 – j4 ohms and Z_r = 0 + j3 ohms are connected in parallel. Solve for the pf of the combination.

A. 0.653 leading B. 0.554 lagging
C. 0.503 leading D. 0.620 lagging

Problem 246: EE Board October 1983

A pure capacitance of 530.515 x 10^{-6} farad and an inductance of 530.515 × 10^{-14} henry are connected in parallel across an AC power source. Solve for their resultant impedance assuming that the frequency is 30 Hz.

A. 10Ω B. Infinite C. Zero D. Undefined

Problem 247:EE Board March 1998

A coil of a 50-ohm resistance and of 150 mH inductance is connected in parallel with a 50 μF capacitor. What is the power factor of the circuit?

A. 80% B. 50% C. 70% D. 60%

Problem 248:EE Board April 1982

Three impedances Z_a, Z_c, Z_r are connected in parallel. If at 60 Hz, Z_a=0+j8, Z_c=0-j2 and Z_r=5+j0 ohms. Solve for the resultant power factor.

A. 0.471 lagging B. 0.471 leading C. 0.573 lagging D. 0.573 leading

Problem 249:EE Board October 1997

A resistor of 50 ohms and an impedance of 100 + j 50 ohms are connected in parallel across a 220 volts supply. What is the power factor of the load?

A. 96% B. 99% C. 98% D. 95%

Problem 250:EE Board April 1990

A capacitor, an electric resistance heater, and an impedance are connected in parallel to a 120 V, 60 Hz system. The capacitor draws 50 VAR, the heater draws 100 W and the impedance coil draws 269 VA at a pf of 0.74 lagging. Determine the system power factor.

A. 0.933 lagging B. 0.928 lagging C. 0.916 lagging D. 0.911 lagging

Problem 251:

A given load takes 40 kVA at 50% lagging power factor, while another load connected in parallel across the same source takes 80 kVA at 86.7% lagging power factor. Find the apparent power.

A. 114.5 kVA B. 117.2 kVA C. 116.4 kVA D. 115.3 kVA

Problem 252:

A 440 V, 60 Hz generator, supplies two parallel-connected loads A and B. Load A draws an apparent power of 100 kVA at 0.80 pf lagging and load B draws an apparent power of 70 kVA at unity pf. Determine the kVAR supplied by the generator

A. 109.5 kVAR B. 120.2 kVAR C. 104.3 kVAR D. 115.7 kVAR

Problem 253:EE Board April 1992

Two single- phase motors are connected in parallel across a 120-volt, 60-cycle source of supply. Motor A is a split-phase induction type and motor B is a capacitor type:
Determine total power factor.

A. 0.886 lag B. 0.864 lag C. 0.817 lag D. 0.825 lag

Problem 254:

A 250-kVA, 0.5 lagging power load is connected in parallel to a 180-W, 0.8 leading power factor load and to a 300-VA, 100 VAR inductive load. Determine the total apparent power in kVA.

A. 628 B. 548 C. 615 D. 704

Problem 255:EE Board April 1992

A 250 V, 30 Hz generator supplies power to a parallel circuit consisting of a 20 hp motor whose efficiency is 90% at 0.80 pf lagging and a second load that draws an apparent power of 7 kVA at unity pf. Determine the system power factor.

A. 0.828 lagging B. 0.831 lagging C. 0.802 lagging D. o.884 lagging

Problem 256:EE Board April 1985

A resistance of 5 ohms is connected in series with a capacitor of 442.1 μF. The combination is then connected in parallel with an inductance of 21.22 mH. Solve for the resultant current if the circuit is connected across a 120 V, 60 Hz AC source.

A. 9.44 A B. 10.68 A C. 11.29 A D. 10.34 A

Problem 257:

Two impedances $Z_1 = 3 + j\ 4$ and $Z_2 = 5 - j\ 8.66$ ohms respectively are connected in parallel. If the combination is connected across a 240 V AC source, how much is the total current?

A. 44.4 A B. 42.1 A C. 40.6 A D. 39.9 A

Problem 258:

A coil having a resistance of 30 ohms and an inductance L is connected in parallel with a resistor having a resistance of 100-ohm. The combination is connected across a 100-V, 60 Hz source. If the power delivered by the source is 400 W, find the value of L.

A. 0.204 H B. 0.011 H C. 0.026 H D. 0.107 H

Problem 259: EE Board April 1993

An inductor $L_1$is connected in series with a parallel combination of inductor L_2 and capacitor C. The impedance of the circuit w= 400 ra/sec is j100 ohms. The circuit is to yield infinite impedance at w= 1, 000 rad/sec and zero impedance at w= 2000 rad/sec. Determine the value of C.

A. 1.26 μF B. 1.67 μF
C. 2.06 μF D. 1.32 μF

Problem 260:

A resistor and an inductor are connected in parallel across a 120- V, 60 Hz source. if the total current and power are respectively 15 A and 1600 watts, solve for the inductance of the inductor.

A. 50.2 mH B. 48.3 mH
C. 43.2 mH D. 46.3 mH

Problem 261:

An inductive coil with a resistance R and inductance L is connected in parallel with a 30- ohm resistor. The combination is then connected across a 60 Hz AC source. If the current in the coil, resistor and the total are 6, 4 and 8 A, respectively, determine the inductance L of the coil.

A. 51.36 mH B. 48.32 mH
C. 60.35 mH D. 53.62 mH

Problem 262: EE Board April 1992

A sinusoidal current source, 10 cos 1000t, is in parallel both with a 20- ohm resistor and the series combination of a 10- ohm resistor and a 10- mH inductor. Find the equation of the voltage across the 10- ohm resistor.

A. $63.25 \cos (1000t - 18.43^o)$ B. $61.32 \cos (1000t - 20.34^o)$
C. $59.36 \cos (1000t - 17.45^o)$ D. $60.12 \cos (1000t - 19.38^o)$

Problem 263: EE Board April 1993

A 1-hp, 220 V, 60 Hz capacitor- start motor has main and auxiliary winding impedance at starting of 3.5 + j2.5 ohms and 8.6 + j2.5 ohms, respectively. Determine the value of the starting capacitance that will place the main and auxiliary winding currents 90^o apart from starting.

A. 186.75 μF B. 174.35 μF
C. 182.43 μF D. 170.67 μF

Problem 264: EE Board October 1990

Two impedances A and B are connected in parallel across a 120- V AC supply. The total current and the current in each impedance are adjusted to 20 A. The power drawn by A is doubled that of B and the power factor is lagging. Determine power factor of A.

A. 0.650 lagging B. 0.704 lagging
C. 0.841 lagging D. 0.677 lagging

Problem 265: EE Board March 1998

A coil of 50- ohm resistance and of 150- mH inductance is connected in parallel with a 50- μF capacitor. The source voltage is $100 \sin (wt + 30^o)$. What is the equation of the line current?

A. $1.91 \sin (wt + 52.5^o)$ B. $1.25 \sin (wt + 75.5^o)$
C. $1.82 \sin (wt - 62^o)$ D. $1.32 \sin (wt - 75.5^o)$

Problem 266: EE Board October 1984

A resistor R is connected in parallel with a 10- ohm inductive reactance. The combination is then connected in series with a 4- ohm capacitive reactance. The whole combination is connected across a 100- volt, 60 Hz supply. How much is R if the angle between the supply voltage and the total current is 45 degrees.

A. 12 Ω B. 25 Ω C. 16 Ω D. 20 Ω

Problem 267:

A resistance of 20 ohms and an unknown capacitance are connected across a 110 V, variable frequency AC source. When the frequency is 60 Hz, the current drawn by the circuit is 6 A. At what frequency will the current drawn falls to 5.8 A?

A. 42.33 Hz B. 50.12 Hz
C. 46.02 Hz D. 44.18 Hz

Problem 268:

A single- phase capacitor- start squirrel- cage induction motor take 2.5 A from a 220- V line. The current in the starting winding is 1.3 A and the current in the main winding is 1.45 A. The total power input is 550 W. What is the resistance of the main
Winding? Assume the auxiliary winding takes a leading current while the main winding takes a lagging current.

A. 139.43 Ω B. 125.68 Ω
C. 142.45 Ω D. 151.97 Ω

Problem 269:

An inductive reactance of 10 ohms is connected in parallel with a capacitive reactance of 30 ohms. If the combination is connected in series with a 10 ohm resistance, solve for the equivalent power factor of the whole combination.

A. 0.555 lagging B. 0.586 lagging
C. 0.603 lagging D. 0.623 lagging

Problem 270:

A resistor R and a variable capacitor C are connected in parallel. The combination is then connected in series with an inductive reactance of 25 Ω. The circuit is energized by 110-V, 60 Hz source. If the capacitance is varied until the voltage across the resistor and that across the inductor are equal to the supply voltage, determine the real power supplied by the source.

A. 537 W B. 419 W C. 620 W D. 402 W

Problem 271:EE Board April 1980

Three impedances Z_1=1-j4, Z_2= -j6 and Z_3= 4+ j3 ohms respectively are connected in series parallel. Z_1 is connected in series with the parallel combination of Z_2 and Z_3. Determine the equivalent impedance of the combination.

A. 4.32 – j1.21 B. 2.23 – j3.32 C. 6.76 – j5.68 D. 5.42 – j7.21

Problem 272:

An inductive reactance of 3 ohms is connected in parallel with a capacitive reactance of 4 ohms. If the combination is connected in series with a 4-ohm resistance, solve for the power factor of the whole combination.

A. 0.333 B. 0.409 C. 0.567 D. 0.316

Problem 273;

An inductive reactance of 10 ohms is connected in parallel with a capacitive reactance of 30 ohms. If the combination is connected in series with a 10-ohm resistance, solve for total real power if the whole circuit is connected across a 240 V, 60 Hz supply.

A. 2.05 kW B. 2.87 kW C. 1.77 kW D. 1.25 kW

Problem 274:EE Board October 1984

A 5-ohm resistor is connected in parallel with a 10-ohm inductive reactance. The combination is then connected in series with a 4-ohm capacitive reactance. The whole combination is connected across a 100-volt, 60 Hz supply. How much is the total current drawn by the circuit?

A. 22.36 A B. 20.45 A C. 23.16 A D. 19.89 A

Problem 275:EE Board April 1983

A non-inductive resistor is connected in parallel with an inductive reactance of 10 ohms. The combination is then connected in series with a capacitive reactance of 5 ohms. The whole combination is connected across a 100-V, 60 Hz AC source. If R is equal to 5 ohms, solve for the voltage across the parallel combination.

A. 87.53 V B. 88.34 V C. 89.44 V D. 91.87 V

Problem 276:EE Board April 1980

Three impedances Z_1 = 1 – j4, Z_2 = -j6 and Z_3 = 4+j3 ohms respectively are connected in series parallel. Z_1 is connected in series with the parallel combination of Z_2 and Z_3. If this circuit is connected across a 230 V, Hz source, determine the voltage across the parallel combination of Z_2 and Z_3.

A. 156.3 V B. 146.8 V C. 135.7 V D. 163.2 V

Problem 277:

A 30-ohm resistor is connected in parallel with a 0.106-H inductor. The parallel combination is then connected in series with a 98-F capacitor. If the whole circuit is connected across a 125 V, 60 Hz, find the current through the inductor.

A. 4.51 A B. 3.26 A C. 2.72 A D. 2.34 A

Problem 278:EE Board October 1980

Given three impedances: Z_1=10+j0, Z_2=3+j4 and Z_3=8-j6. Impedance Z_2 and Z_3 are connected in parallel and the combination is connected in series with impedance Z_1 across 120 V single-phase 60 Hz source. Find the total power drawn by the impedances.

A. 1008 W B. 1204 W C. 1038 W D. 1103 W

Test 9 - Single-Phase AC System: Part III

Problem 279:EE Board October 1993

If admittance Y = 0.06 – j 0.08 mho, then conductance G equals,

A. –0.06 B. 0.06 C. 0.08 D. –0.08

Problem 280:EE Board October 1986, EE Board April 1993

A parallel circuit consists of a resistor having a conductance of 4 mhos, an inductive reactor having a susceptance of 8 mhos and a capacitive reactor having a susceptance of 5 mhos. What is the impedance of the circuit?

A. 0.11 + j0.13 B. 0.13 + j0.11 C. 0.12 +j0.16 D. 0.16 + j0.12

Problem 281:

Two parallel branches have admittances 0.3 + j0.4 and 0.2 – j0.25, respectively, If the current in the first branch is 10 A, determine the total current supplied to the parallel combination.

A. 10.44 A B. 12.10 A C. 15.32 A D. 11.24 A

Problem 282:EE Board October 1994

A capacitor branch having a ratio of X_c to R of 5 is paralleled with an impedance consisting of a 4 Ω resistance and a 3 Ω inductive reactance. The power factor of the resulting circuit is 0.8 leading. Find the size of the capacitor in microfarads if the frequency is 60 Hz.

A. 879.9 B. 1078.9 C. 978.9 D. 778.9

Problem 283:

Two impedances Z_1 = 2 + j 4 and Z_2 = R + j0 are connected in parallel. Determine R so that the power factor of the circuit is 0.9 lagging.

A. 3.2 ohms B. 2.1 ohms C. 2.8 ohms D. 2.5 ohms

Problem 284:

What value of resistance should be placed in parallel with a 50 μF capacitor in order to have a total power factor of 0.8 on a 60-cycle AC system?

A. 50 Ω B. 40 Ω C. 42 Ω D. 47 Ω

Problem 285:EE Board April 1993

Capacitor of 30-microfarad capacitance is in series with a coil across an 8,000-cycle supply. What inductance is required for resonance?

A. 14.34 μH B. 10.45 μH C. 13.19 μH D. 12.55 μH

Problem 286:

A series RLC circuit is connected across a 110-V, variable frequency source. When the frequency is varied, the maximum effective current is 5.5 A and occurs at a frequency of 45 cps.. At this frequency, the voltage across the capacitor is 200.8 V. Find the pf of the circuit at 60 Hz.

A. 0.686 lagging B. 0.770 lagging C. 0.673 lagging D. 0.602 lagging

Problem 287:EE Board October 1998

One leg of a radio-tuned circuit has a capacitance of one times ten to the minus nine farad. It is turned at 200 kHz, what is the inductance of the other leg in henry?

A. 6.33×10^{-4} B. 8.25×10^{-5} C. 20×10^{-3} D. 120×10^{-3}

Problem 288:EE Board April 1998

A loud speaker whose inductance is 1.15 henries is coupled to a power tube through a condenser of 2 μF capacity. To what frequency will the combination be resonant?

A. 110 Hz B. 108 Hz C. 105 Hz D. 100 Hz

Problem 289:EE Board April 1995

What capacitance must be placed in series with an inductance of 0.05 H so that at 100 Hz, the impedance becomes equal to the ohmic resistance?

A. 50.7 μF B. 35.5 μF C. 70.7 μF D. 87.0 μF

Problem 290: EE Board April 1989

A coil has a resistance of 50 ohms and a reactance of 100 ohms, is shunted by a capacitor, which has practically no losses in order that the voltage across the coil be in the phase with the total current supplied to the parallel combination. What is the impedance of the parallel combination under the given condition?

A. 250 ohms B. 200 ohms
C. 230 ohms D. 220 ohms

Problem 291: EE Board April 1983

A non- inductive resistor R is connected in parallel with an inductive reactance of 10 ohms. The combination is then connected in series with a capacitive reactance of 5 ohms. Solve for R at which the power factor of the given circuit would be unity.

A. 10 Ω B. 12 Ω C. 13 Ω D. 11 Ω

Problem 292:

A 10- ohm resistor is connected in parallel with an inductive reactance of 10 ohms. The combination is then connected in series with a capacitive reactance of 6 ohms. Solve for the frequency at resonance. The indicated values have been derived at 50 Hz.

A. 68.08 Hz B. 61.22 Hz
C. 67.51 Hz D. 64.23 Hz

Problem 293:

A 300- ohm inductive reactance is connected across a series combination of a resistor R and a capacitive reactance X_c. Solve for R if the equivalent impedance of the combination is a pure resistance of 100 ohms.

A. 92 ohms B. 88 ohms
C. 78 ohms D. 90 ohms

Problem 294: EE Board October 1982

Two impedances $Z_1 = 15 + j20$ and $Z_2 = 5 – j\ X_c$ are connected in parallel. Solve for the value of X_c so that the total current drawn by the combination will be in phase with any supply voltage.

A. 28.54 Ω B. 30.43 Ω
C. 33.12 Ω D. 29.55 Ω

Problem 295:

A coil whose resistance is 10 Ω and an inductance of 50 mH is connected in parallel with a series combination of 5 Ω resistance and a variable capacitor C. The circuit is supplied by a 220- V, 60 Hz frequency. Calculate the power (minimum value for X_c) delivered by a source at resonance.

A. 10.31 kW B. 15.35 kW
C. 14.65 kW D. 11.07 kW

Problem 296: EE Board April 1985

A resistance of 5 ohms is connected in series with a capacitor of 442.1 μF. The combination is then connected in parallel with an inductance of 21.22 mH. Solve for the frequency of the impressed voltage with which the inductive reactance is equal to the capacitive reactance in magnitude.

A. 50 Hz B. 51 Hz
C. 52 Hz D. None of these

Problem 297:

An impedance of 4 – j3 ohms is connected in parallel with an ideal inductor L across a 110 V, 60 Hz mains. Determine L if the total voltage supplied to the circuit will be in phase with the total current drawn.

A. 16.6 mH B. 19.2 mH
C. 22.1 mH D. 26.8 mH

Problem 298: EE Board April 1989

A coil has a resistance of 50 ohms and a reactance of 100 ohms, is shunted by capacitor, which has practically no losses. What must be the reactance of the capacitor in order that the voltage across the coil be in phase with the total current supplied to the parallel combination?

A. 120 ohms B. 127 ohms C. 125 ohms D. 132 ohms

Problem 299: EE Board April 1982

Three impedances Z_a, Z_c, Z_r are connected in parallel. If at 60 Hz, $Z_a = 0 + j8$, $Z_c = 0 – j2$ and $Z_r = 5 + j0$ ohms. Solve for the frequency at resonance.

A. 30 Hz B. 34 Hz C. 36 Hz D. 28 Hz

Problem 300:

A resistance R is connected in parallel with a variable inductive reactance X_L. The combination is connected in series with impedance of 5 – j2 ohms. Solve for R, such so there is only one condition of resonance as X_L as varied.

A. 2 ohms B. 5 ohms
C. 3 ohms D. 4 ohms

Problem 301: EE Board April 1981

A resistor R is connected in parallel with a 20- ohm inductive reactance. The combination is then connected in series with 5- ohm capacitive reactance. Solve for the value of R at which the power factor of the resultant impedance is unity.

A. 10.05 Ω B. 9.15 Ω
C. 11.55 Ω D. 10.73 Ω

Problem 302:

A coil consumes 2, 000 watts, while drawing a current of 25 A from a 110- V, 100- Hz AC source. Determine the capacitance of the capacitor to be connected in parallel with the coil in order to make the total current be in phase with the supply voltage.

A. 236 μF B. 240 μF
C. 248 μf D. 205 μF

Problem 303:

A coil having an impedance of 10 + j5 ohms is connected in parallel with a series combination of a variable resistance R and a capacitor having a reactance of 8 ohms. The combination is connected across a 24- V AC source. Determine the total current drawn if R is adjusted in order to bring the total pf of the circuit to unity.

A. 3.32 A B. 4.54 A C. 2.28 A D. 4.07 A

Problem 304: EE Board October 1998

A coil has resistance of 50 ohms and the reactance of 70 ohms. A capacitor is connected in parallel to produce resonance. The source voltage is 120 V. What is the power drawn by the circuit?

A. 162 W B. 97 W C. 132 W D. 52 W

Problem 305:

A coil whose resistance is 100 Ω and inductance of L_1 is connected in parallel with a series combination of inductance L_2 and capacitance C. When $w = 1 \times 10^5$, the impedance of the whole combination is 300 ohms, purely resistive. When $w = 2 \times 10^5$ no current flows towards the coil. Find the value of C.

A. 38.23 nF B. 34.02 nF
C. 35.36 nF D. 32.77 nF

Problem 306:

A series RLC circuit has a Q of 5.0 at its resonance frequency of 100 kHz. Assuming the power dissipation of the circuit is 100 W when drawing a current of 0.8 A, determine the capacitance C of the circuit.

A. 2.04 nF B. 2.32 nF
C. 3.02 nF D. 2.54 nF

Problem 307:

An impedance coil draws an apparent power of 50 volt- amperes and an active power of 40 watts. Solve for the Q- factor of the coil.

A. 0.6 B. 1.25 C. 0.8 D. 0.75

Problem 308: EE Board April 1995

A coil is supplied with 200 volts and takes a current (rms) of 2 amperes at 0.707 lagging. The quality factor (Q) of the coil is

A. 25 B. 1 C. 10 D. 100

Problem 309:

A non- inductive resistor of 10 ohms requires a current of 8 A and is to be feed from a 200 V, 50 Hz supply. If a choking coil of effective resistance 1.2 ohms is used to cut down the voltage, find the required Q- factor of the coil.

A. 18.6 B. 14.2 C. 20.3 D. 16.7

Problem 310:

The total current in the given circuit has the equation:
$I = 10 + 16 \sin wt - 8 \sin wt + 5 \cos 3wt$. Calculate the effective value of the current.

A. 18.3 A B. 12.2 A
C. 16.5 A D. None of these

Problem 311: EE Board April 1992

Determine (rms) value of the current drawn by a 2 μF condenser, which is connected across a source of potential. The potential has a third and fifth harmonic components, which are 20 % and 30 % respectively of the fundamental. The fundamental sinusoidal component has a peak value of 1000 volts and 60 Hz frequency.

A. 0.89 A B. 0.75 A C. 0.91 A D. 0.84 A

Problem 312: EE Board October 1992

A capacitor of 3.8 microfarads is connected in parallel with a resistance of 2000 ohms. The combination is further connected in series with an inductance of 795 mH and resistance of 100 ohms across a supply given by $e = 40 \sin wt + 80 \sin (3wt + 60^o)$. Assume w = 314 radians/sec. Determine the rms value of the total current.

A. 0.40 A B. 0.33 A C. 0.56 A D. 0.45 A

Problem 313: EE Board April 1991

Determine the effective value of the circuit current if an emf of 151 sin 377t is connected in series with a DC emf of 110 volts. Both supply a load of 10 + j8 ohms.

A. 10.3 A B. 12.5 A C. 13.8 A D. 11.4 A

Problem 314: EE Board April 1994

An alternating current and a direct current flows simultaneously in the same conductor. If the effective value of the alternating current is 5 A and the direct current is 10 A, what will an AC ammeter read when connected in circuit?

A. 7.5 A B. 15 A
C. 11.18 A D. None of these

Problem 315: EE Board April 1993

A $100\angle 0^o$ V 120 Hz generator and a $80\angle 0^o$ V 60 Hz generator are connected in series with a 60 V battery and coil. The resistance and inductance of the coil are 3Ω and 2.65 mH, respectively. Determine the rms current of the coil.

A. 42.54 A B. 44 24 A
C. 43.55 A D. 40 44 A

Problem 316:EE Board April 1997

If e = 100 sin (wt + 30°) – 50 cos 3wt + 25 sin (5wt + 150°) and I = 20 sin (wt + 40°) + 10 sin (3wt + 30°) – 5 sin (5wt - 50°). Calculate the power in watts.

A. 1177 B. 918.5 C. 1043 d. 922.4

Problem 317:

Find the average power in a resistance R = 10 ohms, if the current in the Fourier- series form is I = 12 sinwt + 8 sinwt +3 sin 5wt amperes.

A. 1085 W B. 1203 W C. 1150 W D. 1027 W

Problem 218:EE Board October 1992

A capacitor of 3.18 microfarads is connected in parallel with a resistance of 2,000 ohms. The combination is further connected in series with an inductance of 795 mH and resistance of 100 ohms across a supply given by e = 400 sinwt + 80 sin (3wt + 60°). Assume w = 314 radians/sec. Determine the power dissipated.

A. 74.66 W B. 78.05 W C. 80.28 W D. 75.66 W

Problem 319:

A series RL circuit in which R= 5 Ω and L= 20 mH has an applied voltage e=100 + 50 sin wt + 25 sin 3wt, with w= 500 radians per sec. Determine the power dissipated in the resistor of the circuit.

A. 2510 W B. 2234 W C. 2052 W D. 3202 W

Problem 320:

Three sinusoidal generators and a battery are connected in series with a coil whose resistance and inductance are 8 Ω and 26.53 mH, respectively. The frequency and rms voltages of the respective generators are 15 V, 20 Hz; 30 V, 60 Hz and 40 V, 100 Hz. The open circuit of the battery is 6 V. Neglect internal resistance of the battery. Find the apparent power delivered by the circuit.

A. 194.4 VA B. 178.5 VA C. 198.3 VA D. 182.7 VA

Problem 321:

A series circuit containing a 295 μF capacitor and a coil whose resistance and inductance are 3 Ω and 4.42 mH, respectively are supplied by the following series connected generators: 35 V at 60 Hz, 10 V at 180 Hz and 8 V at 240 Hz. Determine the power factor of the circuit.

A. 0.486 B. 0.418 C. 0.465 D. 0.437

Problem 322:EE Board 1992

A capacitor of 3.18 microfarads is connected in parallel with a resistance of 2,000 ohms. The combination is further connected in series with an inductance of 795 mH and resistance of 100 ohms across a supply given by e= 400 sinwt + 80 sin (3wt + 60°0. Assume w=314 radians per sec. Determine the circuit power factor.

A. 0.702 B. 0.650 C. 0.633 D. 0.612

TEST 10 - Three-Phase AC System: Part I

Problem 323:EE Board April 1997

A 170 kV, 3-phase electric source delivers 200 MVA to a balanced load, which has a power of 90% lagging. What is the line current?

A. 275 A B. 502 A C. 402 A D. 679 A

Problem 324:EE Board October 1997

A three-phase motor is rated 50 hp, 440 volts and 85% power factor. What is its rated current?

A. 61.5 A B. 57.5 A C. 55 A D. 59 A

Problem 325:EE Board April 1985

A balanced 3-phase load draws 120 amperes line current at 230 volts line to line, 0.848 pf lagging current. Solve for the real power.

A. 40.54 kW B. 42.35 kW C. 41.45 kW D. 43.15 kW

Problem 326:EE Board March 1998

A generator supplies three-phase power to balanced load. The voltage is 230 volts, the current is 18 A and the power factor is 85%. What is the power?

A. 3.6 kW B. 1.6 kW C. 6.1 kW D. 1.4 kW

Problem 327:EE Board April 1984

A balanced 3-phase load draws 75 amperes line current at 230 V line to line and 0.848 lagging power factor. Solve for the reactive power being drawn.

A. 15.83 kVAR B. 15.26 kVAR C. 15.35 kVAR D. 15.94 kVAR

Problem 328:EE Board April 1990

The input power factor to a three-phase, 6-poles, 460 volts, 60 Hz, 50-hp induction motor is 0.62 as 20 A is drawn by the motor. Find the power input to the motor.

A. 9,880 W B. 9,675 W C. 9,895 W D. 9,478 W

Problem 329:EE Board April 1990

A 460 volt, three-phase motor draws 208 A with a power factor of 0.91 lagging. Calculate the kW input to the motor.

A. 150.8 B. 156.3 C. 152.4 D. 160.3

Problem 330:

Determine the ratio of the line current drawn by three identical impedances connected in wye to the line current drawn by the same impedances connected in delta. Both connections being impressed with the same balance 3-ϕ voltages.

A. 1:2 B. 3:4 C. 2:3 D. 1:3

Problem 331;EE Board April 1993

A wye-connected load has a 5∠20° ohm impedance per phase and is connected across a 120-V three-phase source. Calculate the line current.

A. 24 A B. 13.85 A C. 41.56 a D. 15.45 A

Problem 332:

A balanced delta connected load having impedance per phase of $20\angle 36.87°$ ohms is supplied from a balanced 3-phase, 240 V source. Determine the total real power.

A. 6824 W B. 6912 W C. 7015 W D. 6740 W

Problem 333:EE Board April 1993

Three condensers, each having capacity of 75 microfarads are connected in star to a 440 volts, 3-phase, 50 cycles supply. Calculate the capacitance of each of the three condensers so that when they are connected in delta to the same supply the line current remains the same.

A. 20 μF B. 28 μF C. 25 μF D. 30 μF

Problem 334:EE Board March 1998

Three impedances, -j10, j10 and 10 ohms are wye connected. Determine the impedance of an equivalent delta.

A. 12.5, j12.5, -12.5 ohms B. 10, j10, -j10 ohms
C. j8.5, -j12.5, 8 ohms D. 5, j5, -j5 ohms

Problem335:

A system consisting of three equal resistors connected in star is fed from a three-phase supply. By how much is the power reduced if one of the three resistors is disconnected?

A. 1/3 B. 3/4 C. 1/2 D. 2/3

Problem 336:EE Board April 1993

A balanced three-phase load is wye-connected and has an impedance $Z_p = 4 – j\ 3$ ohms per phase. Find the line current if this load is connected across a 220 V three-phase source.

A. 25.4 A B. 22.3 A C. 20.5 A D. 26.7 A

Problem 337:EE Board October 1998

Three 10-ohm resistances are connected delta on a balanced three-phase source. If the equation of the phase V_{an} =120 sin wt. What is the equation of the line current in line a?

A. 20.78 sin (wt + 30°) B. 13.15 sin (wt - 30°0
C. 12 sin (wt – 56.56°) D. 36 sin wt

Problem 338:EE Board April 1982

Given a balanced 3-wire, three-phase system serving the following loads:

$V_{ab} = 200\angle 0°$ V $Z_{ab} = 10\angle 53.13°\ \Omega$
$V_{bc} = 200\angle 240°$ V $Z_{bc} = 10\angle 0°\ \Omega$
$V_{ca} = 200\angle 120°$ V $Z_{ca} = 10\angle 30°\ \Omega$

Determine line current on line b.

A. 20.34 A B. 22.04 A C. 24.36 A D. 21.57 A

Problem 339:EE Board April 1982

Given the following line volages and two load impedances;

$V_{ab} = 117\angle 0°$ V $Z_{ac} = 5+j12$ ohms
$V_{bc} = 117\angle 240°$ V $Z_{bc} = 13=j0$ ohms
$V_{ca} = 117\angle 120°$ V

Solve for the line current in line c.

A. 17.41 A B. 17.95 A C. 16.62 A D. 18.46 A

Problem 340:EE Board April 1998

Three unequal single-phase loads so connected across the lines of a balanced, 3-phase, 230 volts circuit. The first takes 106 A at 0.78 pf lagging and is connected across lines 1 & 2. The second takes 142 A, at 0.82 pf

lagging and is connected across a lines 2 & 3. And the third takes 28.4 kW at 0.77 pf lagging and is connected across lines 3 & 1. find the three lines currents.

A. 254.40 A, 211.38 A, 252 A
B. 231.26 A, 215.20 A, 268 A
C. 254.40 A, 215.20 A, 252 A
D. 231.26 A, 211.38 A, 268 A

Problem 341:EE Board October 1992

A 120-V per phase, three-phase Y connected source deliveres power to the following delta-connected load:

Phase 1 = $40\angle 0°$ Phase 2 = $20\angle -60°$ Phase 3 = $15\angle 45°$

Determine the three line currents.

A. 12.45 A, 9 A, 22.45 A
B. 13.49 A, 9 A, 22.45 A
C. 13.49 A, 10 A, 20.22 A
D. 12.45 A, 10 A, 20.22 A

Problem 342:EE Board October 1985

Given:

$V_{ab} = 240\angle 0°$ V $Z_{ab} = 6 + j8$ ohms
$V_{bc} = 240\angle 240°$ V $Z_{bc} = 5 + j8.66$ ohms
$V_{ca} = 240\angle 120°$ V $Z_{ca} = 10 + j0$ ohms

Solve for the three line currents l_a, l_b and l_c.

A. $l_a = 45$ a, $l_b = 43$ A, $l_c = 20$ A
B. $l_a = 48$ A, $l_b = 42$ A, $l_c = 24$ A
C. $l_a = 45$ A, $l_b = 42$ A, $l_c = 20$ A
D. $l_a = 48$ A, $l_b = 43$ A, $l_c = 24$ A

Problem 343:EE Board April 1985

A three-phase 230-V circuit serves two single phase loads, A and B. Load A is an induction motor rated 8 hp, 230 v, 0.70 pf, 0.90 efficiency, which is connected across lines a and b. Load B draws 5 kW at 1.0 pf and is connected across lines b and c. Assume a sequence of a-b-c, solve for the line current on line b.

A. 42.19 A B. 27.74 A C. 41.08 A D. 34.46 A

Problem 344:

A four wire 208-V three-phase system is used to supply power to a three-phase 5-hp induction motor and a single phase 6 kW heater connected between line c and the neutral line. The operating efficiency and power factor of the motor are 81 and 71 percent, respectively. Calculate the current in line c. Assume a phase sequence of a-b-c.

A. 71 A B. 75 A C. 64 A D. 69 A

Problem 345:EE Board April 1980

A factory is supplied by a three-phase, 3-wire system with the following characteristics:

$V_{ab} = 230\angle 0°$ V $l_a = 110\angle -36.87°$ A
$V_{bc} = 230\angle 240°$ V $l_c = 125\angle 53.13°$ A

Find line current l_b.

A. 145.3 A B. 163.3 A C. 184.6 A D. 166.5 A

Problem 346:

Given a balanced 3-wire, three-phase system serving an unbalanced wye- connected load. Determine the line current in line a.

$V_{ab} = 210\angle 0°$ V $Z_{an} = 10$
$V_{bc} = 210\angle 120°$ V $Z_{bn} = 10 = j10$
$V_{ca} = 210\angle 240°$ V $Z_{cn} = 10$

A. 15 A B. 12 A C. 14 A D. 16 A

Problem 347:EE Board October 1994

Three resistors 10, 15 and 30 ohmic values are connected in wye-configuration to a balanced 208-volt three-phase supply. Calculate the total power of the system.

A. 2644 W B. 2880 W C. 3080 W D. 3280 W

Problem 348:EE Board march 1998

Three impedances each 10 + j5 ohms are connected in delta on a balanced three-phase source. If the equation of the phase voltage is V_{an} = 120 sin wt. What is the equation of the current through the impedance connected across phase A and B?

A. 20.0 sin (wt -22°) B. 18.59 sin (wt + 3.44°)
C. 16.21 sin (wt + 56.56°) D. 21.32 sin (wt – 8.15°)

Problem 349:EE Board June 1990

Two parallel connected loads A and B are supplied by a 440 V, 3-phase, 60 Hz generator. Load A draws an apparent power of 100 kVA at 0.80 pf lagging and load B draws an apparent power of 70 kVA at unity pf. Determine the feeder current.

A. 208 A B. 212 A C. 214 A D. 202 A

Problem 350:

Two different loads A and B are connected across a balanced 230 V, 3-ϕ lines. Load A is a three-phase load that draws 10 kVA at 70% lagging pf. Load B is a single-phase load connected across lines a and b drawing 5 kVA at unity pf. Determine line current in line a. Assume a phase sequence of a-b-c.

A. 37 A B. 42 A C. 31 A D. 46 A

Problem 351:EE Board April 1990

A three-phase motor takes 10 kVA at 0.6 pf lagging from a source of 230 volts. It is in parallel with a balanced delta load having 16 ohms resistance and 12 ohms capacitive reactance in series in each phase. Determine the total power factor.

A. 0.966 lagging B. 0.896 lagging C. 0.917 lagging D. 0.967 lagging

Problem 352:

A balanced delta load whose impedance is 45∠70° ohms per branch, a three-phase motor that draws a total of 10 kVA at 0.65 pf lagging and a wye connected load whose impedance is 10 ohms (resistance) per branch are supplied from a three-phase, three-wire, 208 V, 60 Hz feeder. Determine the overall power factor of the feeder loads.

A. 0.753 B. 0.706 C. 0.826 D. 0.762

Problem 353: EE Board April 1985

A three- phase 230- V circuit serves two single phase loads, A and B. Load A is an induction motor rated 8 hp, 230 V, 0.70 pf, 0.90 efficiency, which is connected across lines a and b. Load B draws 5 kW at 1.0 pf and is connected across lines b and c. Assume a sequence of a-b-c, solve for the total power factor of the load.

A. 0.907 B. 0.704 C. 0.864 D. 0.886

Problem 354:

A 440- V three- phase, 3- wire wire, 60 Hz feeder supplies power to two 30- hp induction motors. One motor is operating at full load, 85% efficiency and has a power factor of 90%. The other motor is operating at one – half of its rated horsepower, 89% efficiency and has a power factor of 78%. What is the overall power factor of the system of motors?

A. 0.862 lagging B. 0.826 lagging
C. 0.838 lagging D. 0.801 lagging

Problem 355: EE Board April 1988

Three unequal single- phase loads so connected across the lines of a balanced, 3- phase, 230 volts circuit. The first takes 106 A at 0.78 pf lagging and is connected across lines 1 & 2. The second takes 142 A, at 0.82 pf lagging and is connected across lines 2 & 3. And the third takes 28.4 kW at 0.77 pf lagging. Determine the total apparent power.

A. 94 kVA B. 83 kVA
C. 78 kVA D. 101 kVA

Problem 356:

Two-balanced Y- connected loads A and B are connected across a three- phase 3- wire balanced system. Load A draws 6 kW at 80% power factor lagging while load B draws 12 kW at 83.5% power factor leading. If the current in the three lines are each equal to 8 A, determine the current drawn by load A.

A. 4.45 A B. 3.58 A C. 4.15 A D. 3.28 A

Problem 357: EE Board March 1998

The phase B line voltage and the phase A line current of a balanced three- phase system are V= 220 sin (wt + 210°) and l = 10 sin (wt – 30°), respectively. What is the power of the system?

A. 1905 W B. 3300 W
C. 5716 W D. 3810 W

Problem 358: EE Board October 1986

The following information is given for a delta- connected load of three numerically equal impedances that differ in power factor: Line voltage = 120 volts; $Z_{ab} = 15\angle 30^o$; $Z_{bc} = 15\angle 0^o$; $Z_{ca} = 15\angle -30$ phase sequence of voltages is a-b-c. Using the phase sequence as a guide, calculate the total power drawn by the load.

A. 2,624 W B. 2,472 W
C. 2,654 W D. 2,731 W

Problem 359: EE Board April 1990

A three- phase motor takes 10 kVA at 0.6 pf lagging from a source of 230 volts. It is in parallel with a balanced delta load having 16 ohms resistance and 12 ohms capacitive reactance in series in each phase. Determine the total line current.

A. 30.05 A B. 34.55 A
C. 32.04 A D. 31.24 A

PROBLEM 360: EE BOARD APRIL 1993

In AC circuits, find the total power in kW in an unbalanced three- phase circuit loaded as follows: Phase l = 120 V, 100 A unity pf. Phase ll = 100 V, 230 A, 80 % pf and phase lll = 110 V, 85 A, 77 % pf.

A. 37.6 kW B. 35.3 kW
C. 32.8 kW D. 31.24 kW

Problem 361: EE Board April 1983

Two single- phase transformers are connected in V (open delta) and serving a delta connected impedance load, each impedance is equal to $16\angle 36.87^o$ ohms. If the transformer voltages impressed on the impedances are:

$V_{ab} = 240\angle 0^o$, $V_{ab} = 240\angle 240^o$, $V_{ab} = 240\angle 120^o$ volts

Solve for the total kVA drawn by the load.

A. 6.23 B. 8.31 C. 10.8 D. 11.3

Problem 361: EE Board October 1980, EE Board October 1982

Three impedances, $Z_{an} = 20 + j0$, $Z_{bn} = 16 + j12$, $Z_{cn} = 5 – j15$ ohms are connected in wye across a 230 V (line to line), 3- phase, 4- wire source. The phase sequence is a-b-c, counterclockwise. Determine the current passing thru the neutral.

A. 7.54 A B. 9.12 A C. 8.81 A D. 8.02 A

Problem 363: EE Board April 1981

A wye- connected transformer with neutral connection has balanced voltages of 265 V between lines and neutral. The transformer is serving two single- phase motors. Motor A (rated 4 hp, 0.90 efficiency, 0.80 power factor lagging) is connected across line a and neutral. Motor B (rated 3 hp, 0.85 efficiency, 0.85 power factor, lagging) is connected across line b and neutral. Solve for the neutral current, using V_{an} as reference vector.

A. 20.42 A B. 25.37 A
C. 22.45 A D. 23.14 A

Problem 364:

Two single- phase motors are connected between the lines and neutral terminals of a 3- phase, 4- wire, 230 V secondary side of a three- phase transformer. Load A is connected across line a and neutral while B is across line b and neutral. The currents l_a and l_b are 40 A, 0.707 pf lagging, and 25 A, unity pf, respectively. Determine the neutral current , l_n.

A. 54.25 A B. 50.34 A
C. 51.86 A D. 52.37 A

Problem 365:

Two single- phase motors are connected to a 3- phase, 4- wire wye feeder having 220 V between phase and the neutral. One motor rated 5 HP, 0.866 pf lagging and 90% eff is connected across phase A and neutral. The second motor is connected across phase C and neutral, and rated 3 HP, 0.707 pf lagging and 90% eff. Solve for current through the neutral.

A. 20.56 A B. 29.54 A C. 21.67 A D. 23.43 A

Problem 366:

A 230- V, three- phase, 4- wire balanced system supplies power to group of lamp loads. If the line currents are respectively 60 A, 86 A and 40 A respectively, solve for the current in the neutral wire. Assume the power factor of lamps to be unity.

A. 40 A B. 14 A C. 66 A D. 36 A

Problem 367: EE Board October 1998

The loads of a wye- connected transformer are:

$I_a = 10 \text{ cis } (-30^o)$
$I_b = 12 \text{ cis } 215^o$
$I_c = 15 \text{ cis } 82^o$

What is the neutral current?

A. $1.04 \text{ cis } 72.8^o$ B. $2.21 \text{ cis } (-30^o)$
C. $0.92 \text{ cis } 62.5^o$ D. $3.11 \text{ cis } 72.8^o$

TEST 11 - Three-Phase AC System: Part II

Problem 368: EE Board April 1980

A factory is supplied by a three- phase, 3- wire system with the following characteristics:

$V_{ab} = 230\angle 0^o$ V $I_a = 110\angle -36.87°$ A
$V_{bc} = 230\angle 240°$ V $I_c = 125\angle 53.13°$ A

Determine the total power consumed by the load.

A. 42.76 kW B. 48.78 kW C. 40.23 kW D. 45.12 kW

Problem 369:

A 3-phase, 3 wire feeder has the following line currents and line voltages:

$V_{ab} = 220\angle 0°$ V $I_{aa} = 30\text{-}j30$ A
$V_{bc} = 220\angle 240°$ v $I_{cc} = 29+j39.8$ A

Determine the reactive power supplied by the feeder.

A. 7.75 kVAR B. 7.34 kVAR C. 8.32 kVAR D. 8.45 kVAR

Problem 370:

Given a balanced three-phase system with the following loads:

$V_{ab} = 230\angle 0°$ V $Z_{ab} = 60$
$V_{bc} = 230\angle 120°$ V $Z_{bc} = 30+j50$
$V_{ca} = 230\angle 240°$ V $Z_{ca} = -j80$

Determine the reading of the two wattmeters properly connected using line c as the common point.

A. 440.9 W, 907.5 W B. 394.1 W, 951.2 W

C. 440.9 W, 951.2 W D. 394.1 W, 907.5 W

Problem 371:

Given a balanced 3-wire, three-phase system serving the following loads:

$V_{ab} = 220\angle 0°$ V $Z_{ab} = 11\angle 0°\ \Omega$

$V_{bc} = 220\angle 240°$ V $Z_{bc} = 11\angle 45°\ \Omega$

$V_{ca} = 220\angle 120°$ V $Z_{ca} = 11\angle 30°\ \Omega$

Determine the reading of the two wattmeters with line b as common.

A. 6921.5 W, 4820 W B. 6921.5 W, 4400 W

C. 6342.5 W, 4650 W D. 6342.5 W, 4400 W

Problem 372:

The following voltages and line currents were measured to a 3-phase, 3-wire feeder serving a commercial building.

$V_{ab} = 2{,}400\angle 0°$ V $Z_{ab} = 85\angle 330°$ A

$V_{bc} = 2{,}400\angle 240°$ V $I_c = 100\angle 80°$ A

Solve for the real power in kW drawn by the commercial building.

A. 402.2 B. 404.5 C. 419.3 D. 421.5

Problem 373:EE Board April 1981

A 3-phase, 3-wire load draws the following line currents:

$I_a = 60\angle 330^o$ A $I_b = 78.4\angle 214^o$ A $I_c = 75\angle 80^o$ A

If the voltages impressed on the load are balanced 3- phase. Having a magnitude of 4140 volts line to line, solve for the total power in kW.

A. 556.15 B. 506.85

C. 536.54 D. 520.18

Problem 374:

Give the following voltages and load impedances:

$V_{ab} = 220\angle 0^o$ V $Z_{ab} = 10\angle 36.87^o\ \Omega$

$V_{bc} = 220\angle 240^o$ V $Z_{bc} = 10\angle 0^o\ \Omega$

$V_{ca} = 220\angle 120^o$V $Z_{ca} = 10\angle 45^o\ \Omega$

Determine the reading of a kW meter connected with its current coil connected in line b while the potential coil connected across lines b and c.

A. 5.12 kW B. 4.26 kW

C. 4.08 kW D. 5.45 kW

Problem 375: EE Board October 1983

Given the following load impedances in delta and is impressed voltages as follows:

$V_{ab} = 220\angle 0^o$ V $Z_{ab} = 8 + j6$

$V_{bc} = 220\angle 240^o$ V $Z_{bc} = 8.66 - j5$

$V_{ca} = 220\angle 120^o$ V $Z_{ca} = 10 + j0$

What will be the reading of the two wattmeters connected to measure total power. Use line a as the common potential point.

A. 3.869 kW, 9.031 kW B. 2.546 kW, 8.357 kW

C. 3.125 kW, 6.778 kW D. 4.055 kW, 9.848 kW

Problem 376: EE Board October 1984

The 3- phase power supply to a factory has the following measurements:

$V_{ab} = 240\angle 0^o$ V $I_a = 120\angle 330^o$ A

$V_{bc} = 240\angle 240^o$ V $I_b = 157\angle 214^o$ A

$V_{ca} = 240\angle 120^o$ V $I_c = 150\angle 80^o$ A

Solve for the total power drawn.

A. 60.2 kW B. 56.5 kW

C. 58.8 kW D. 62.4 kW

Problem 377:

Given $V_{ab} = 220\angle 0^o$ V $V_{bc} = 220\angle -120^o$ V $V_{ca} = 220\angle -240$ V

Determine the reading of the wattmeter as shown.

A. 405.45 W

B. 486.32 W

C. 442.88 W

D. 467.54 W

Problem 378: EE Board April 1985

A balanced 3- phase load draws 120 amperes line current at 230 volts line to line 0.848 pf lagging current. Solve for the readings of the two wattmeters used to measure the 3- phase power.

A. 25.543 kW, 15.087 kW B. 28.155 kW, 12.385 kW

C. 24.365 kW, 16.175 kW D. 27.583 kW, 12.957 kW

Problem 379:

A number of incandescent lamps are connected in delta across the lines of a balanced 230 V, 3- phase, 3- wire system. A single- phase wattmeter is connected in the circuit. The current coil of the meter is connected in line 1 while the potential coil is connected across lines 1 and 3. This wattmeter registers 8.4 kW. If the potential terminal of the meter, which was connected in line 3, is transferred to line 2, the wattmeter reads 7.5 kW. If each lamp rated 100 W, how many lamps are connected across lines 1 and 2. Assume lamp pf to be unity.

A. 42 B. 45 C. 43 D. 44

Problem 380: EE Board April 1988

MERALCO used two wattmeters to measure the balanced 3- phase dynatron elevator motor drive. The current coil of the wattmeters are connected to the current transformers, which are in lines 1 and 2 respectively. The line potential are 230 V and the line currents are each 150 A. The wattmeters each indicate 19.6 kW. Assume load is wye- connected. What is the total power supplied?

A. 49.175 kW B. 48.236 kW

C. 45.461 kW D. 47.350 kW

Problem 381: EE Board April 1992

A 460 volt, three- phase motor draws 208 A with a power factor of 0.91 lagging. Calculate the indications of W_1 and W_2 for the given condition.

A. 75.40 kW, 75.40 kW B. 91.23 kW, 59.58 kW

C. 89.56 kW, 61.25 kW D. 95.24 kW, 55.57 kW

Problem 382:

Two wattmeters are used to measure the power delivered to a balanced delta connected load. Wattmeter 1 reads 1000 W and wattmeter 2 reads 500 W after the current coil terminals are reversed. If the line to line voltage is 208 V, solve for the line current drawn by the load.

A. 8.23 A B. 7.57 A
C. 8.08 A D. 7.34 A

Problem 383:

The power drawn by a three- phase balanced load is measured using two wattmeters properly connected. At what power factor will the reading of one of the wattmeters be zero?

A. 0.866 B. 1.0 C. 0.5 D. 0.707

Problem 384:

Two wattmeters connected to a three- phase 440 V squirrel cage induction motor indicate a total of 12 kW. If the operating power factor of the motor is 0.4, determine the individual reading of the wattmeters.

A. 10.46 kW, 1.60 kW B. 9.24 kW, 2.76 kW
C. 13.94 kW, -1.94 kW D. None of these

Problem 385:

A 3- phase induction motor is connected across a 220- V three- phase source. A wattmeter reads 600 W when its current coil is connected in line 1 and its potential coil across line 1 and 2. if the potential coil of the wattmeter is transferred to lines 2 and 3, the reading of the wattmeter is the same. Calculate the power factor of the motor.

A. 0.766 B. 0.829
C. 0.866 D. 0.707

Problem 386:

Two wattmeters used to measure the total power drawn by a three- phase circuit and are connected properly. The first wattmeter reads 4800 watts while the other reads 400 watts after reversing its current coil. Solve for the load power factor.

A. 0.564 B. 0.532 C. 0.646 D. 0.439

Problem 387: EE Board June 1990

Two- wattmeter method is used to test a 25 HP, 230 volt, 1800 rpm, 60 cycle, 3- phase induction motor. When the line voltages are 230 volts, one wattmeter reads +13,400 watts and the other +7, 400 watts. Determine motor power factor.

A. 0.961 B. 0.886 C. 0.894 D. 0.807

Problem 388: EE Board October 1987

A wound rotor motor, 7.5 HP, 230 volts, 3- phase takes a line current of 18.4 amperes, when operating at rated output at an efficiency of 88%. Calculate the indication of the wattmeter when this is inserted to measure power by the T- method.

A. 3.179 kW B. 4.401 kW
C. 3.361 kW D. 4.042 kW

Problem 389:EE Board October 1994

A wattmeter with its current coil in line 2 and potential coil across lines 2 and 3 is connected to a balanced 3- phase system. The only load supplied is a single phase one connected to lines 1 and 2. This load is known to be inductive. If the wattmeter reads zero watts, determine the power factor of the single-phase load.

A. 0.707 B. 0.866 C. 0.800 D. 0.900

Problem 390:

Three unequal single- phase motor loads are connected across the lines of a balanced 230- V, 60 Hz, three- phase system. Motor #1 is connected across lines 1 and 2 and draws 106 A at 80% pf. Motor #2 is connected across lines 2 and 3 and takes 142 A at 86.6% pf. And motor #3 is connected across lines 3 and 1 takes 164 A at 75% pf. Using two wattmeters properly connected with the common potential point in line 2, what are the reading of these instruments?

A. 62.42 kW, 13.66 kW B. 50.71 kW, 25.37 kW C. 48.21 kW, 27.87 kW D. 46.25 kW, 29.83 kW

Problem 391: EE board April 1984

A balanced 3- phase load draws 75 amperes line current at 230 volts line to line, and 0.848 lagging power factor. If the two- wattmeter method is used, solve for the readings of the wattmeters.

A. 15.32 kW, 10.02 kW B. 17.86 kW, 7.48 kW
C. 16.42 kW, 8.92 kW D. 17.24 kW, 8.10 kW

Problem 392: EE Board October 1980

Three equal impedances, each having a resistance of 8 ohms and an inductive reactance of 7 ohms are connected in delta to lines a, b and c of a 240 V, 3- phase, 3- wire line, phase sequence: a-b-c. What is the reading of a single- phase wattmeter connected with its current coil in line a and potential coil across lines b and c?

A. 6,180 W B. 6, 324 W
C. 6, 561 W D. 6, 004 W

Problem 393:

A balanced three- phase load draws 20 kW at 0.447- pf lagging from a 230- V, 60 Hz three- phase transmission line. Find the readings of the two wattmeters properly connected to measure power?

A. 18.45 kW, 1.55 kW B. 14.25 kW, 5.75 kW
C. 21.55 kW, -1.55 kW D. 25.75 kW, -5.75 kW

Problem 394:

Determine the operating power factor of the three- phase balanced load if the reading of the two wattmeters properly connected to measure power is 3:1.

A. 0.667 B. 0.655 C. 0.756 D. 0.681

Problem 395: EE Boar October 1992

A three- phase feeder carries two lagging balanced loads. The power observed by each is measured by two wattmeters method, giving the following readings:

First load: $W_1 = 160$ kW $W_2 = 96$ kW
Second load: $W_1 = 90$ kW $W_2 = 48$ kW

What is the combined kVA load on the feeder?

A. 434.68 B. 462.36
C. 504.24 D. 420.12

Problem 396:

A single- phase wattmeter is used to determine the power taken by a three- phase squirrel cage induction motor. The current coil is placed in line 1 while the potential coil is shifted from lines 1 and 2, then from lines 1 and 3 respectively. If the wattmeter registers 5760 and 3380 watts respectively, what is the line current drawn by the motor? Line to line voltage is 230 V.

A. 25.17 A B. 23.46 A
C. 34.61 A D. 36.83 A

Problem 397: EE Board October 1992

National Power Corporation used two wattmeters to measure 3- phase power of a balanced Y-connected lagging power factor motor loads. Each wattmeter indicates 15.4 kW. The voltage coils are connected across line 2 and 3 and across lines 1 and 3, respectively. The line-to-line voltages are 230 volts with V_{12} leading V_{23} and the line currents are each 120 A. Calculate the total power supplied.

A. 37.44 kW B. 30.72 kW
C. 39.67 kW D. 34.88 kW

Problem 398:

A three- phase, 600 V balanced system supplies energy to an unbalanced delta connected load. The three line currents l_a, l_b, l_c are 141.4 A, 100 A and 100 A respectively. A wattmeter with its current coil in line a and potential coil across a and b indicates 84.84 kW. Solve for the total power drawn by the load. Assume a sequence a-b-c.

A. 102.45 kW B. 100.37 kW
C. 107.25 kW D. 110.12 kW

Problem 399:

Three equal non- inductive resistances are connected in star across a balanced 400 V, 60 Hz system. A single- phase wattmeter is connected on the system with its current coil in line 1 and potential coil in lines 1 and 3. This wattmeter registers 900 W. if line 2 is accidentally open circuited, what will be the wattmeter reading under this condition?

A. 900 W B. 1200 W C. 600 W D. 300 W

Problem 400:

A balanced three- phase load having a resistance of 10 ohms and a reactance of 10 ohms are connected in star across the lines of a balanced 230 V three- phase supply. Find the reading on each two wattmeters properly connected to measure the power drawn.

A. 2055 W, 589 W B. 2085 W, 559 W
C. 2165 W, 479 W D. 2105 W, 539 W

Problem 401:

An unbalanced delta- connected load is connected across the lines of a 4- wire balanced three-phase supply with neutral connection. Two wattmeters W_1, W_2 are connected in lines 1 and 3 with a common potential connection in the neutral wire. These wattmeters read 1796.5 and 3000 watts, respectively. The current lines 1 and 3 are 20 and 25 A, respectively. If the common potential connection is transferred to line 2, what will be the reading of the two wattmeters? The system voltage per phase is 208 V. Assume a phase sequence of 1-2-3 with V_{1n} as reference.

A. W_1 = 4013 watts, W_2 = 4560 watts
B. W_1 = 4043 watts, W_2 = 4530 watts
C. W_1 = 4063 watts, W_2 = 4510 watts
D. W_1 = 4073 watts, W_2 = 4500 watts

Problem 402:

Two wattmeters are used to measure the total power drawn by a balanced delta connected load. If the wattmeter reads 1200 W and 800 W respectively, and the line to line voltage is 208 V, solve for the impedance per phase of the load.

A. 56.31 + j23.67 ohms B. 57.94 + j20.07 ohms
C. 50.31 + j31.72 ohms D. 52.47 + j23.82 ohms

Problem 403:

Two wattmeters used to measure the total power drawn by the three- phase circuit and are connected properly. One of the wattmeters read 10 kW when the power factor of the load is unity. What does each wattmeter read when the power factor fall to 0.866 lagging? Assume the total three- phase power remains the same.

A. 12.45 kW, 7.55 kW B. 13.33 kW, 6.67 kW
C. 15.25 kW, 4.75 kW D. 10.67 kW, 9.33 kW

Problem 404: EE Board April 1980

A factory is supplied by a three- phase, 3- wire system with the following characteristics. Determine the average power factor of the load.

$V_{ab} = 230\angle 0^o$ V $l_a = 110\angle 36.87^o$ A
$V_{bc} = 230\angle 240^o$ V $l_c = 125\angle 53.13^o$ A

Problem 405: EE Board October 1981

A three- phase, 3- wire load draws the following line currents:

$L_a = 60\angle 330^o$ A $l_b = 78.4\angle 214^o$ A $l_c = 75\angle 80^o$ A

If the voltages impressed on the load are balanced three- phase, having a magnitude of 4140 volts line to line, solve for the power factor of the load.

A. 0.976 B. 0.999 C. 0.982 D. 0.906

Test 12 – Electrical Transients

Problem 406: EE Board April 1979, EE Board October 1982

In an RL circuit, Kirchhoff' s Law gives the following relation: E = L di/dt + Ri where: E = supply voltage (200 volts)
R = resistance (20 ohms)
L = inductance (1 henry)
t = time in seconds
i = current in amperes
If i = 0 when t = 0.02 second.

A. 3.3 A B. 3.1 A C. 3.2 A D. 3.0 A

Problem 407: EE Board October 1980

In an RL circuit, Kirchhoff's Law gives the following relation: E= L di/dt + Ri where: E = supply voltage (200 volts)
R = resistance (20 ohms)
L = inductance (1 henry)
t = time in seconds
i = current in amperes
If i = 0 when t = 0, find i after a long time.

A. 10 A B. 11.2 A C. 0 D. infinite

Problem 408: EE Board October 1990

A 6.0 H coil whose resistance is 12 ohms is connected in series with a 24 ohms resistor and to a 144 V battery and a switch. The switched is closed at t= 0. Determine the time constant of the circuit.

A. 0.36 sec B. 0.45 sec
C. 0.66 sec D. 0.50 sec

Problem 409:

The current in the coil decays as follows: when t = 0.002 sec, the current is 10 mA; when t= 0.006 s, the current drops to 4 mA. The time constant of the coil is —.

A. 4.50 ms B. 4.28 ms
C. 4.36 ms D. 2.15 ms

Problem 410: EE Board April 1990

A time of 10 milliseconds is required for the current on a series RL dc circuit to reach 90% of its final steady state value. Assume at t= 0, i(0) = 0. What is the time constant in seconds for the circuit?

A. 4.25 ms B. 3.86 ms
C. 3.39 ms D. 4.04 ms

Problem 411:

A coil has a resistance of 10 ohms and a time constant of 1 second. If the coil is connected across a steady potential of 24 V, how much is the current after 2 ms?

A. 4.07 mA B. 4.79 mA
C. 4.91 mA D. 4.04 mA

Problem 412: EE Board April 1995

The shunt winding of machine has a resistance of 80 ohms and an inductance of 4 H is suddenly switched on to a 220- V supply. Find the time taken for the current to rise to half its steady state value.

A. 0.05 sec B. 0.0346 sec
C. 0.0251 sec D. 0.0172 sec

Problem 413:

A dc voltage E is applied across an RL circuit at t= 0. At what time after, is the voltage across the resistor equal to that across the inductor?

A. 0.693 TC B. 0.673 TC
C. 0.707 TC D. 0.779 TC

Problem 414:

A 500- ohm relay coil has an inductance of 10 mH. This relay requires a current of 40 mA in order to trigger. How long after the switched is closed will the relay trigger if a 24 V DC source is applied across its terminals. Assume at t= 0, i= 0.

A. 23.54 μsec B. 1.750 μsec
C. 35.83 μsec D. 37.22 μsec

Problem 416:

A coil having a resistance of 10Ω and inductance of 10 H is connected in series with a 15Ω resistor. A 200- V DC source is connected to the circuit at t= 0. Determine the voltage across the coil at t= 0.05 sec.

A. 190.86 V B. 188.51 V
C. 178.62 V D. 185.90 V

Problem 417:

A series RL circuit is connected across a dc source through a switch. Three (3) milliseconds after the switch is closed, the voltage across the inductance is 20 V and drops to 5 V after 20 ms. If R = 100 ohms, find L. Assume at t= 0,l = 0.

A. 1.30 H B. 1.22 H C. 1.59 H D. 1.25 H

Problem 418:

A 1Ω resistor is connected in series with a 2- mH inductor. If a 12- V dc source is suddenly connected across its terminals, how long will it take, such that the voltage across the resistor will be twice as that of the inductor.

A. 2.5 ms B. 1.7 ms C. 2.2 ms D. 1.9 ms

Problem 419:

A resistance of 100 kΩ is connected in series with a 100 μF capacitor. If the combination is suddenly connected across a 125 V DC source, determine the current one second after the switch is closed.

A. 1.13 mA B. 1.25 mA
C. 1.05 mA D. 1.12 mA

Problem 420: EE Board October 1992

An uncharged condenser in series with a 120- volt voltmeter of 10, 000 ohms resistance is suddenly connected to a 100 V battery. One second later, the voltmeter reads 60 volt. Determine the capacitance of the condenser.

A. 187.54 μF B. 190.62 μF
C. 195.76 μF D. 192.23 μF

Problem 421:

A 120 μF capacitor has an initial charge of 600 μC. It is discharged through a 40 Ω resistor. How long will it take in order for a capacitor to discharge at 150 μC?

A. 6.65 ms B. 6.82 ms
C. 4.66 ms D. 5.85 ms

Problem 422:

A 50 μF capacitor is connected across a 400 V dc source. It is then discharged through a voltmeter whose resistance is 100- kΩ. How long will it take for a capacitor to discharge at 1.8 J of stored energy?

A. 2.3 s B. 1.9 s C. 2.0 s D. 1.6 s

Problem 423: EE Board April 1999

A 20- ohm resistance R and a 0.001 farad capacitance C are in series. A direct current voltage E of 100 volts is applied across the series circuit at t= 0 and the initial current i(0) = 5 A. The applicable differential equation is:

$$R(di/dt) + i/c = 0$$

Solve the differential equation and determine the resulting current i(t) at t= 0.01 second.

A. 3.34 A B. 3.67 A C. 2.78 A D. 3.03 A

Problem 424: EE Board October 1991

A series RC circuit consist of R = 2 MΩ and an uncharged capacitor C = 5 μF. The circuit is connected cross a 100 VDC source at t= 0. Determine the the voltage across the resistor 5 seconds later.

A. 63.31 V B. 60.65 V
C. 66.24 V D. 69.22 V

Problem 425: EE Board October 1992

An uncharged condenser in series with a 120- voltmeter of 10,000 ohms resistance is suddenly connected to a 100 V battery. One second later, the voltmeter reads 60 volt. Determine the rate at which the voltage across the condenser is charging.

A. $51\ e^{-0.55\ t}$ B. $51\ e^{-0.51\ t}$
C. $55\ e^{-0.55\ t}$ D. $55\ e^{0.51\ t}$

Problem 426: EE Board October 1981

In a circuit consisting of a resistance, R ohms, in series with a capacitance, C farad, and connected to a dc source with emf E volts, the electrical charge, Q coulombs and the current i, amperes, maybe determined by solving the simultaneous equations:

$$Ri + \frac{Q}{C} = E \quad \text{and} \quad l = \frac{dQ}{dt}$$

If R = 20 ohms, C = 250 x 10^{-6} farad and E = 100 volts, find i after a long time.

A. 1 A B. 0 A C. infinity D. 5 A

Problem 427:

An 80 μF capacitor in series with a voltmeter of 10, 000 ohm resistance is connected suddenly across a 100- V supply. How long will it take for the voltmeter to register 15 V?

A. 1.84 sec B. 1.52 sec
C. 1.63 sec D. 1.25 sec

Problem 428: EE Board April 1993

A 100 μF capacitor initially charged to 24 V is discharged across a series combination of a 1 kΩ resistor and a 200 μF capacitor. Find the current after 1 sec.

A. 7.34 nA B. 7.24 nA
C. 8.43 nA D. 8.84 nA

Problem 429:

An 80 μF capacitor in series with a 1000- ohm resistor is connected suddenly across a 110 V DC supply. Find the value of the current after one time constant.

A. 0.0405 A B. 0.0652 A
C. 0.0543 A D. 0.0322 A

Problem 430: EE Board October 1991

A series RC circuit consist of R = 2 MΩ and an uncharged capacitor C = 5 μF. the circuit is connected across a 100 VDC source at t = 0. What is the initial rate of change of voltage across the resistor?

A. -10.0 V/s B. 10.0 V/s
C. -12.4 V/s D. None of these

Problem 431:

A series RLC circuit with R = 1 kΩ, L = 1 H, C = 6.25 μF is suddenly connected across a 24 V dc source. At t= 0, i = 0 and q= 0. Determine the current after 0.01 sec.

A. 3.45 mA B. 4.61 mA
C. 5.40 mA D. 5.05 mA

Problem 432:

A series RLC circuit has R= 200 Ω, L= 0.1 H and a capacitor C= 10 μF. If a 100 V dc source is connected across the end terminals of the series circuit at t= 0, determines the current after 1 millisecond. Assume zero initial conditions.

A. 0.353 A B. 0.229 A C. 0.253 A D. 0.368 A

Problem 433;

A series RLC has R= 40 ohms, L=100 mH and C= 50 μF. The circuit is connected across a 100 V dc source at t= 0 through a switch. Determine the current 0.02 second after the switch is closed. Assume all initial condition to be zero.

A. 6.40 mA B. 5.31 mA C. 6.22 mA D. 4.85 mA

Problem 434:EE Board March 1998

A 10-ohm resistance R and a 1.0- henry inductance L are connected in series. An AC voltage e(t) = 100 sin 377t is applied across the series circuit. The applicable differential equation is:

$$Ri + L\,(di/dt) = e(t)$$

Solve for the particular solution (without the complimentary solution) and determine the amplitude of the resulting sinusoidal current I i(t).

A. 0.321 A B. 0.292 A C. 0.241 A D. 0.265 A

Problem 435:EE Board April 1991

A certain electric welder has a basic circuit equivalent to a series RL with R= 0.1 Ω and L = 1 mH. It is connected to an AC source “e” through a switch “s” operated by an automatic timer, which closes the circuit at any desired point on the 60 cycle, sinusoidal wave “e”. Calculate the magnitude of the transient current resulting when “s” closes as “e” is passing through its peak value of 100 volts.

A. 265.41 A B. 65.74 A C. 80.54 A D. 76.32 A

Problem 436:EE Board October 1999

Given the differential equation:

$$L\,di/dt+Ri= 100 \sin (377t)$$

Where L= 0.1 henry, R= 10 ohms and i(0)= 0. Determine the current at t= 0.01 second.

A. 2.784 B. 2.301 C. 2.531 D. 3.062

Problem 437:

A series RC circuit with R= 30 ohms and C= 250 μF is connected across an AC voltage source of emf 100 sin 100t through a switch. The switch is closed at t= 0. Determine the current when t= 0.01 second. Assume at t= 0, voltage across the capacitor is zero.

A. 1.45 A B. 1.24 A C. 0.93 A D. 2.05 A

Problem 438:EE Board April 1999

A series RC circuit has R= 10 ohms, L= 0.1 henry and C= 0.0001 farad. An AC voltage e= 100 sin 377t is applied across the series circuit and the applicable differential equation is:

$$L\,(d^2i/dt^2)+R(di/dt)+(1/C)I= de/dt$$

Solve for the particular solution (without the complimentary solution) and determine the amplitude of the resulting sinusoidal current i(t).

A. 5.51 A B. 6.06 A C. 6.67 A D. 7.34 A

Problem 439:EE Board October 1999

A 10-ohm resistance R and a 0.001 farad capacitance C are in series. An AC voltage e = 100 sin 377t is applied across the series circuit. The applicable differential equation is:

$$R(di/dt)+(1/C)I= de/dt.$$

Solve for the particular solution (without the complimentary solution) and determine the amplitude of the resulting sinusoidal current i(t).

A. 9.67 A B. 10.63 A C. 8.79 A D. 11.70 A

Problem 440:

A series RL circuit has R = 10 ohms and L = 1 henry. The circuit is connected across a voltage source $e(t) = 10\ e^{-10t}$ through a switch that is initially open. The switch is closed at t = 0. Determine the current after 0.01 second. Assume initial current to be zero.

A. 86.8 mA B. 90.5 mA C. 89.3 mA D. 92.2 mA

Problem 441: EE Board October 1999

The differential equation of a series RC circuit with DC applied voltage is:

$$Ri + 1/C \int idt = E.$$

If R = 50 ohms, C = 0.0001 farad, E = 100 volts and i(0) = 2.0 amperes, determine the laplace transform expression for l(s).

A. l(s) = 2/ s + 200 B. l(s) = 2/ s (s + 2)
C. l(s) = 2/ s + 50 D. l(s) = 2/ s + 2

Problem 442:

A series RC circuit has R = 1kΩ and C = 100 μF with an initial charge of 2000 μC. The combination is connected across a 100 V dc source and the switch is closed at t = 0. If the capacitor is connected in the circuit such that it will be discharging, determine the laplace transform expression of the current drawn.

A. $i_{(s)} = 0.12/ s + 10$ B. $i_{(s)} = 0.12/ s + 12$
C. $i_{(s)} = 0.10/ s + 10$ D. $i_{(s)} = 0.10/ s + 12$

Problem 443: EE Board March 1998

Determine the inverse laplace transform of $i_{(s)} = 200/ s^2 + 50s + 10625$.

A. $i_{(t)} = 2\ e^{-25t}\sin 100t$ B. $i_{(t)} = 2t\ e^{-25t}\sin 100t$
C. $i_{(t)} = 2\ e^{-25t}\cos 100t$ D. $i_{(t)} = 2t\ e^{-25t}\cos 100t$

Problem 444: EE Board March 1998

A DC ammeter has an internal resistance of 0.1 ohm. A shunt of 1.010×10^3 ohm is connected to the ammeter. What is the multiplier of the set up?

A. 80 B. 100 C. 50 D. 10

Problem 445:

A 1% d'Arsonval meter movement has coil and swamping resistance adding to 200 ohms. The full scale voltage is 50 mV. Determine the shunt resistance required producing 1 A full scale current meter?

A. 52.02 mΩ B. 49.22 mΩ C. 50.01 mΩ D. 48.74 mΩ

Problem 446:

A galvanometer with a 20- ohm coil resistance has full scale deflection current of 10 mA. If a 0.02 ohm is placed across the meter to increase its capacity, what is the approximate new full scale current of the meter?

A. 10.10 A B. 11.01 A C. 10.11 A D. 10.01 A

Problem 447:

A moving iron meter gives full scale deflection with 100 V applied across the coil. The coil has 20, 000 turns and a resistance of 2.5 kΩ. If this instrument is to used as an ammeter with a full scale deflection of 10 A, how many turns are needed?

A. 80 B. 100 C. 50 D. 70

Problem 448:

A moving iron ammeter is wound with 50 turns and gives full scale deflection with 4 A. If it is desired to extend the full scale reading to 10 A, how many turns are needed on the same bobbin?

A. 40 B. 20 C. 10 D. 30

Problem 449:

A galvanometer has a coil resistance of 50 ohms and a current sensitivity of 0.001 μA per mm. How much is the voltage across its terminals when the deflection is 15 cm at full scale?

A. 7.50 μV B. 10.0 μV C. 8.25 μV D. 9.05 μV

Problem 450: EE Board October 1994

A 0- 10 mA galvanometer with a coil resistance of 20 ohms is converted to a 0- 50 V voltmeter by using

A. 50 ohms shunt resistor B. 4980 ohms series resistor
C. 5000 ohms series resistor D. 5020 ohms series resistor

Problem 451: EE Board October 1992

A certain 50 μA meter movement has a resistance of 90 ohms. What value of series multiplier is needed to make the instrument to read 5 V (maximum).

A. 102 kΩ B. 99.91 kΩ C. 110 kΩ D. 98 kΩ

Problem 452:

A voltmeter with an internal resistance of 5000 ohms is calibrated to read 10 volts at full scale. How much series resistance is needed in order to measure 150 volts at full scale?

A. 70 kΩ B. 75 kΩ C. 72 kΩ D. 78 kΩ

Problem 453:

A 1000 ohms per volt, 2% meter movement has a coil resistance of 200 ohms. Determine the external resistance necessary to provide full scale reading of 5 V.

A. 4.5 kΩ B. 5.2 kΩ C. 5.0 kΩ D. 4.8 kΩ

Problem 454:

An ammeter rated 5 A, having a resistance of 0.5 Ω, is to be converted into a 200 V voltmeter by connecting a resistor in series with the ammeter. Calculate the value of this resistance.

A. 37.4 Ω B. 34.6 Ω C. 39.5 Ω D. 35.5 Ω

Problem 455:

A direct current wattmeter with a potential coil connected across the load side of the instrument reads 250 W. If the voltage across the load is rated 230V, what is the actual power drawn by the load. The resistance of the potential coil is known to be 1 kΩ.

A. 194.2 W B. 197.1 W C. 193.5 W D. 189.6 W

Problem 456: EE Board April 1992

The stator of a 440 V, 50- hp shunt motor is tested at 75ºC for its insulation resistance between terminals connected together and the ground frame. When a 50,000- ohm voltmeter is connected in series with a 600- V DC source and the insulation resistance, the meter indicates 125 V. Calculate the insulation resistance.

A. 170 kΩ B. 190 kΩ C. 180 kΩ D. 200 kΩ

Problem 457:

It is desired to measure the resistance of the insulation between the motor winding and the motor frame. A 300- V, 50,000 ohm voltmeter is used in making the measurements. The voltmeter when connected across the source reads 230 V and when connected in series with the insulation, it reads 5 V. Find the insulation resistance.

A. 2.42 MΩ B. 2.25 MΩ C. 2.96 MΩ D. 2.35 MΩ

Problem 458:

When a 150 kΩ voltmeter is connected across a constant source, it registers 230 V. When one terminal is connected to the core of a cable while the rubber insulation of the cable is connected to the other terminal of the line, the meter registers 15 V. Determine the insulation resistance of the cable.

A. 2150 kΩ B. 2000 kΩ C. 2202 kΩ D. 2480 kΩ

Problem 459:

An unknown voltage is to be measured by means of a 250 V scale voltmeter having an internal resistance of 10,000 ohms. For safety purposes a 1000 ohms resistor is connected in series with one of the voltmeter terminals. If the meter reads 200 volts, determine the unknown voltage.

A. 250 V B. 220 V C. 230 V D. 300 V

Problem 460:

Two identical 1000 ohm per volt DC voltmeter are connected in series to measure an unknown supply voltage. The first voltmeter is connected to its 200 V scale while the second voltmeter is connected to its 250 V scale. What is the voltage of the supply if the first voltmeter reads 100 V?

A. 225 V B. 220 V C. 230 V D. 242 V

Problem 461:

A 20 kΩ per volt voltmeter indicated a reading of 250 V on its 300 V scale when used to measure an unknown voltage. If a 50 kΩ resistor was connected in series with the instrument during the test, determine the value of the unknown voltage.

A. 238 V B. 235 V C. 248 V D. 225 V

Problem 462:

A 300- V voltmeter draws 2- mA current for full scale deflection. This voltmeter is used to measure the voltage across a 50 kΩ resistor in series with a 25 kΩ resistor. The combination of the resistors is being connected across a 150- V source. What is the voltmeter reading?

A. 98 V B. 102 V C. 90 V D. 88 V

Problem 463: EE Board October 1986

The MERALCO test of a 10- A wattmeter having a constant of 0.4, the disk makes 40 revolutions in 53.6 seconds. The average volts and amperes during this period of test are 116 volts and 9.4 A. What is the percent accuracy of the meter at this load?

A. 97.45% B. 98.58% C. 98.07% D. 96.44%

Problem 464: EE Board April 1992

In a test of a 10- ampere wattmeter having a constant of 0.40, the disk makes 40 revolutions in 55 seconds. The average volts and amperes during this period are 116 volts and 10 amps. Determine the percent accuracy of this meter at this load.

A. 92.34% B. 91.03% C. 83.46% D. 90.28%

Problem 465:

A given ampere- hour meter is under test by connecting it across a 230-V DC source. For a duration of 180 minutes, a constant current of 20 A flows. This meter registers 570.5 and 582.3 kW-hr before and after the test respectively. Calculate the percentage accuracy of the meter.

A. 92.31% B. 90.02% C. 91.44% D. 89.20%

Problem 466:

A 15 A, 120- V watthour meter has a disk constant of 2. When tested on a unity power factor load, 24 disk revolutions are counted in a period of 2 minutes. How many disk revolutions would be counted per minute if the power factor were changed to 0.5 lagging. Assume the same line current and voltage in both conditions.

A. 6 B. 10 C. 8 D. 12

Problem 467:

A single- phase three wire, 60 Hz, 220 V watthour- meter has a disc constant of 1.2. Determine the energy recorded by the meter after 18,000 revolutions of the disc.

A. 21.6 kW-hr B. 20.5 kW-hr C. 25.4 kW-hr D. 27.6 kW-hr

Problem 468:

A 115- V, 10 A, three- phase watt-hour meter, having a basic meter constant of k = 2/3 is connected to a three- phase, three- wire circuit through a 100:5 ampere CT and 2300:115 volt PT. A time check shows that the meter disk is making 15 revolutions in 50 seconds. What is actual kW of the load?

A. 720 kW B. 288 kW C. 524 kW D. 380 kW

Problem 469: EE Board March 1998

A power plant customer draws power at 220 volts from transformers on a pole. Current transformers with ratio of 200/5 are used to meter the electrical usage. What is the multiplier of the kW-hr and demand meters?

A. 40 B. 200 C. 100 D. 80

Problem 470:

A current transformer with a turns ratio of 100:5 and a potential transformer with a turns ratio of 10:1 are connected to the current and voltage coils of a single phase wattmeter measuring power delivered to a load. If the wattmeter reading is 240 W, what is the actual power measured delivered to the load?

A. 50,000 watts B. 42,000 watts
C. 48,000 watts D. 45,000 watts

Problem 471: EE Board October 1997

At a 115 kV substation, the PT ratio is 1000 and the CT ratio is 1200/5. The potential going into the wattmeter is 115 volts. What is the MW indicated when the wattmeter reads 800 watts?

A. 192 MW B. 15.0 MW C. 19.2 MW D. 150 MW

Problem 472:

A 15 A, 120- V watt- hour meter has a disk constant of 2. When tested on a 0.8 power factor load, 24 disk revolutions are counted in a period of 3 minutes. Calculate the current drawn from the load.

A. 10 A B. 8 A C. 6 A D. 12 A

Problem 473:

In a given test, it was found out that with a current of 40 A, the disc of a given ampere- hour meter made 160 revolutions in 4 minutes. If the meter constant of the instrument is 50 coulombs per revolution, determine the multiplying factor to be used in order to give the correct energy consumption of the load.

A. 0.833 B. 0.707 C. 0.922 D. 0.866

Problem 474:

An unknown resistor R_x as shown is to be measured by means of a Wheatstone bridge, when the ratio arms are arranged R_1 = 10 ohms and R_2 = 1200 ohms, balance is obtained when rheostat arm is equal to 1256 ohms, what is the value of the unknown resistor?

A. 10.47Ω
B. 11.24Ω
C. 13.22Ω
D. 14.05Ω

Problem 475:

An unknown resistance x as shown is measured by a slide wire bridge (a simple form of Wheatstone bridge) AC is a uniform wire 100 cm long and D is a sliding contact. Balanced is obtained when AD equals 32.5 cm. Find the value of the unknown resistance x.

A. 45.32Ω
B. 48.14Ω
C. 50.04Ω
D. 43.44Ω

Problem 476:

A two- conductor underground cable 2800 ft long is used to interconnect a home base station to another station. One conductor is grounded at some point. A Murray loop test was conducted at the home base with a 100 cm slide wire bridge. If a balance on the bridge was obtained at 76 cm, at what distance is the fault from the home base?

A. 1287 ft B. 1415 ft C. 1344 ft D. 1302 ft

A. 0.704 ohm B. 0.732 ohm C. 0.712 ohm D. 0.739 ohm

Problem 537:

Problem 477:

A four-pole, DC generator with lap winding has 48 slots and 4 elements per slot. How many coils does it have?

A. 48 B. 384 C. 192 D. 96

Problem 478:

If the armature of an eight-pole machine were wound with a simplex wave winding, how many parallel paths would there be?

A. 16 paths B. 8 paths C. 2 paths D. 4 paths

Problem 479:

The armature of a four-pole shunt generator is lap wound and generates 216 volts when running at 600 rpm. The armature has 144 slots, with six conductors per slot. If this armature is rewound, wave connected, find the emf generated at the same speed and flux pole.

A. 412 V B. 427 V C. 465 V D. 432 V

Problem 480:

A two-pole Dc generator has an armature containing a total of 40 conductors connected in two parallel paths. The flux per pole is 6.48 x 10^8 lines and the speed of the prime mover is 30 rpm. The resistance of each conductor is 0.01 ohm and the current carrying capacity of each conductor is 10 A. calculate the terminal voltage of the generator.

A. 127.6 V B. 125.2 V C. 130.8 V D. 128.4 V

Problem 481:

A four-pole Dc generator has an armature winding containing a total of 648 conductors connected in two parallel paths. If the flux per pole is 0.321 x 10^6 maxwells and the speed of rotation of the armature is 1,800 rpm. Calculate the ampacity required in each armature conductor if the power developed by the armature is 5 kW.

A. 40 A B. 30 A C. 20 A D. 25 A

Problem 482:

A four-pole DC generator with duplex lap winding has 48 slots and four elements per slot. The flux per pole is 2.5 x 10^6 maxwells and it runs at 1500 rpm. What is the output voltage?

A. 60 V B. 360 V C. 225 V D. 120 V

Problem 483:

The armature of a 4-pole, 128 slots shunt generator is lap wound with four conductors per slot. The flux per pole is 50 mWb. The armature and shunt field resistances are 0.04 ohm and 50 ohms respectively. Determine the speed of the machine when supplying 400 A at a terminal voltage of 250 V.

A. 615 rpm B. 622 rpm C. 634 rpm D. 624 rpm

Problem 484:

A four-pole shunt connected generator has a lap connected armature with 728 conductors. The flux per pole is 25 mWb. If the generator supplies two hundred fifty 110 V, 75 W incandescent lamp. The field and armature resistances are 110 ohms and 0.025 ohm respectively. Determine the speed in rpm of the generator.

A. 364 B. 386 C. 377 D. 393

Problem 485:

A speed-indicating device consists of a 2-pole permanent magnet Dc generator with a 2000-ohms DC voltmeter connected across its terminals. The generator has an armature with 1200 conductors having two parallel paths and a total resistance of 1000 ohms between brushes. The air gap flux is 40,000 lines per pole. If the voltmeter reads 10 V, at what speed will this reading indicates?

A. 1534 rpm B. 1562 rpm C. 1512 rpm D. 1582 rpm

Problem 486:

A shunt generator supplies a load of 5,500 W at 110 V through a pair of feeder conductors having a resistance of 0.02 ohm each. The armature, shunt field resistances are 0.15 ohm and 50 ohms respectively. Find the emf generated.

A. 119 V B. 118 V C. 121 V D. 120 V

Problem 487:

The no-load voltage of a 50-kW, 220 volts, shunt generator in the FEU laboratory is 232 volts and rated load voltage is 220 volts. The armature resistance including brushes, is 0.026 ohm and the resistance of the shunt field resistance is 52 ohms. What is the induced electromagnetic force at rated load?

A. 221.36 V B. 226.02 V C. 224.56 V D. 227.05 V

Problem 488:

The field current of a 180 kW, 250 volts DC shunt generator is 6 A when running full load at rated terminal voltage. If the combined armature and brush resistance is 0.02 ohm, solve for the electrical efficiency of the generator.

A. 92.13% B. 94.05% C. 93.73% D. 91.87%

Problem 489: EE Board June1990

The field circuit of a 200,000 watts, 230- V shunt generator is 8 A when running full load at rated terminal voltage. If the combined brush and armature resistance is 0.03 ohm, solve for the electrical efficiency of the generator.

A. 85.34% B. 89.14% C. 88.91% D. 87.82%

Problem 490: EE Board October 1980

The field current of a 100 kW, 250 volt shunt generator is 5 amperes when delivering power at rated terminal voltage and at rated load current. The combined armature and brush resistance is 0.01 ohm. Determine the efficiency of the generator.

A. 97.2% B. 94.3% C. 98.2% D. 94.7%

Problem 491: EE Board April 1997

The armature of the shunt generator has 0.05 ohm effective resistance. Each brush has an effective resistance of 0.01 ohm. The terminal voltage is 100 volts while the current is 40 amperes. What is its efficiency?

A. 95.15% B. 97.65% C. 97.30% D. 96.52%

Problem 492:

A shunt generator is connected to a load that draws 28.8 kW. Ra = 0.04 Ω and Rsh = 48 Ω. If the power developed in the armature is 106.3% of the power delivered to the load. Determine the terminal voltage of the generator.

A. 238 V B. 240 V C. 234 V D. 236 V

Problem 493:

A 15 kW, 230 V, shunt generator was run light as a motor to determine its stray power losses at rated load. The applied voltage across the armature, computed for test was 254 V and the armature current drawn is 2 A. The armature and shunt field resistances are 0.25 and 100 Ω respectively. Calculate the generator efficiency at half load. Assume stray power losses to be constant.

A. 81.34% B. 84.83% C. 83.77% D. 87.07%

Problem 494:

A shunt generator supplies 100 A at 200 V. The armature and shunt resistances are 0.025 Ω and 100 Ω, respectively. If the copper losses are equal to the iron losses at this load, find the brake horsepower of the engine driving the generator.

A. 26.43 hp B. 28.58 hp C. 30.12 hp D. 32.24 hp

Problem 495:

A 20 kW, 200 V shunt generator is operated at rated load. If the driving engine is developing 30 bhp, determine the iron and friction losses. Armature resistance is 0.05 ohm and shunt field resistance is 50 ohms.

A. 1340 W B. 1039 W C. 954 W D. 1034 W

Problem 496:

A 220 V shunt generator has an armature resistance of 0.02 Ω and a shunt resistance of 44 Ω. At rated load, the driving engine develops 62.25 hp. If the iron and friction losses amount to 1600 W, how much is the current delivered to the load at rated condition?

A. 189 A B. 200 A C. 195 A D. 192 A

Problem 497: EE Board October 1996 and EE Board April 1997

A DC generator has no- load output voltage of 120 volts. Its armature circuit resistance is 0.95 ohm and its field coils are separately energized. If the load is rated 2 kW at 115 V. Neglecting the effect of armature reaction, what power could be delivered to the load?

A. 1,518 W B. 2,180 W C. 1,670 W D. 2,000 W

Problem 498:

The armature of a 6- pole separately excited DC generator is lap wound with 534 conductors. This machine delivers power to the load at 250 V while being driven at 1000 rpm. At this load, the armature circuit dissipates 640 W. If the flux per pole of this generator is 30-mWb, determine the kW rating of the load served. Assume a total brush contact drop of 2 V.

A. 10.67 kW B. 11.24 kW C. 12.56 kW D. 15.44 kW

Problem 499:

A separately excited generator when running at 1200 rpm supplies 200 A at 125 V to a circuit of constant resistance. Armature circuit resistance is 0.10 ohm. Determine the terminal voltage when the speed is dropped to 1000 rpm? Assume that the field current is unaltered.

A. 104 V B. 125 V C. 118 V D. 114 V

Problem 500:

A dc series generator is supplying a current of 5 A to a series lighting system through a feeder of total resistance, 1.0 ohm. The terminal voltage is 2500 V. The armature and series field resistances are respectively 18 and 15 ohms respectively. A 30-ohm diverter resistance is shunted across the series field. Determine the power developed in the armature of the generator?

A. 132.25 kW B. 137.50 kW C. 123.29 kW D. 136.80 kW

Problem 501:

A 30 kW series generator has an efficiency of 88 percent when operating at rated load. If the stray power loss is 15% of the full load losses, calculate the maximum efficiency of the generator. Assume that the stray power loss is constant and the other losses vary as the square of the load.

A. 90.43% B. 92.04% C. 91.12% D. 89.92%

Problem 502:

The hysteresis and eddy current losses of a DC machine running at 1000 rpm are 250 watts and 100 watts, respectively. If the flux remains constant, at what speed will the total iron loss be halved?

A. 500 rpm B. 550 rpm C. 570 rpm D. 630 rpm

Problem 503:

The eddy current loss in a DC machine is 600 watts when the total flux is 2,000,000 maxwells per pole and the machine is running at 1000 rpm. Determine the loss when the excitation of the machine is adjusted to produce 2,500,000 maxwells per pole and the speed is increased to 1200 rpm.

A. 900 watts B. 1025 watts C. 1280 watts D. 1350 watts

Problem 504:

In a DC generator, the iron losses at 1,000 rpm are 10 kW at a given field current. At a speed of 750 rpm and at the same field current, the total iron losses become 6 kW. Assume the hysteresis loss is directly proportional to the speed and the eddy current loss is proportional to the square of the speed. Determine the iron losses at 500 rpm.

A. 4 kW B. 5 kW C. 3 kW D. 2 kW

Problem 505:

A compound dynamo supplies a load of 20 kW at 400 V through a feeder having a resistance equal to 0.1 ohm. The shunt and series field resistances are 85 ohms and 0.06 ohm respectively. Determine the total electromotive force when the generator is connected long shunt. Assume a brush contact drop of 1 V per brush and an armature resistance of 0.1 ohm.

A. 418.34 V B. 412.50 V C. 415.76 V D. 421.44 V

Problem 506:

A long shunt compound generator has the following parameters: Ra = 0.1 Ω, Rse = 0.05 Ω and Rsh = 120 Ω. This machine supplies power aggregate dc load of 10 kW. At this load the armature generates 246 volts. Determine the terminal voltage.

A. 251.55 V B. 257.86 V C. 253.82 V D. 247.33 V

Problem 507:

A compound generator is to be operated, as a flat-compounded long shunt compound generator. To obtain the same rated voltage at full load and at no load when operated as a shunt generator, it is necessary to increase the field current by 0.20 A. The shunt field winding has 1000 turns per pole, and the series field winding has 4 turns per pole. If the full load armature current of the compound generator is 95 A and the series field resistance is 0.025 ohm, calculate the diverter resistance required.

A. 0.068 Ω B. 0.042 Ω C. 0.028 Ω D. 0.034 Ω

Problem 508:

The armature, series field and shunt field resistances of a 125 kW, 250-V long shunt cumulative compound DC generator are 0.025 Ω, 0.01 Ω and 30 Ω, respectively. If the stray power loss at rated loss is 5 kW, determine the or brake horsepower required to drive this machine. Assume a brush drop of 2 V and a stray load loss of 1% of the output.

A. 182.32 hp B. 201.33 hp C. 190.85 hp D. 210.56 hp

Problem 509:

A long shunt compound generator delivers 100 A, 250 V at rated load. The resistances of the various windings are: Ra = 0.1Ω, Rip = 0.02Ω, Rsh = 100Ω and Rse = 0.025Ω. If the stray power losses amount to 1.8 kW, solve for the overall efficiency of the generator.

A. 90.52% B. 87.43% C. 88.32% 86.36%

Problem 510:

A certain 5.5 kW, 125-V DC long shunt compound generator was operated as a shunt motor at no load for determination of stray power losses. With 135 V equal to the generated emf at full load applied to the armature and at normal speed of 1700 rpm, the current input to the armature was found to be 2.5 A. The armature, shunt field and series field resistances are 0.2 Ω, 25 Ω and 0.25 Ω, respectively. Determine the efficiency of the generator at rated load.

A. 84.52% B. 83.57% C. 80.21% D. 82.23%

Problem 511:

A compound dynamo supplies a load of 20 kW at 400 V through a feeder having a resistance eual to 0.1 ohm. The shunt and series field resistances are 85 ohms and 0.06 ohm respectively. Determine the total electromotive force when the generator is connected short shunt. Assume a brush contact drop of 1 V per brush and an armature resistance of 0.01 ohm.

A. 415.48 V B. 411.42 V C. 416.23 V D. 412.42 V

Problem 512:

A short shunt compound generator has the following has an armature, series field and shunt field resistances are 0.04 ohm, 0.03 ohm and 80 ohms respectively. The generator serves a 20 kW, 200 V load through a feeder with an equivalent resistance of 0.01 ohm. Solve for the power generated by the armature.

A. 23.84 kW B. 21.30 kW C. 22.29 kW D. 21.92 kW

Problem 513:

A short shunt compound generator has an armature, shunt field and series field resistances of 0.02 Ω, 80 Ω and 0.03 Ω respectively. The generator's induced emf is 510 V when the terminal voltage is 500 V. how much load current is delivered under this condition.

A. 197.47 A B. 190.46 A C. 194.53 A D. 192.72 A

Problem 514:

A short shunt field compound generator delivers 150 at a terminal voltage is 230 V. The shunt field current is 2.5 A. The resistance of the armature, series field and diverter are 0.032 Ω, 0.015 Ω and 0.03 Ω, respectively. Calculate the electrical efficiency of the generator at this load.

A. 96.4% B. 93.8% C. 94.2% D. 95.7%

Problem 515:

Two shunt DC generators G_1 and G_2 are rated at 100 and 150 kW at 110 V respectively. Their external load characteristics may be considered as straight line. The drop in the terminal voltage from no-load to full- load is 10 volts for G_1 and 20 volts for G_2. Calculate the no- load voltages of these generators when they are operated in parallel to supply a load of 2000 A, which is divided between them in proportion of their ratings.

A. G_1 = 123.7 V, G_2 = 133.7 V B. G_1 = 123.7 V, G_2 = 131.7 V
C. G_1 = 121.7 V, G_2 = 133.7 V D. G_1 = 121.7 V, G_2 = 131.7 V

Problem 516:

Two shunt generators operating in parallel are giving a total output of 320 kW.

Generator	Armature Resistance	Induced emf
A	0.02 ohm	450 V
B	0.025 ohm	460 V

Find the bus bar voltage. Neglect shunt field current.

A. 450.3 V B. 446.5 V C. 423.4 V D. 464.2 V

Problem 517:

Two identical shunt generators running in parallel supply a total load current of 2500 A. Each machine has a field resistance of 50 ohms and an armature resistance of 0.01 ohm. The induced emfs generated are 230 and 235 volts, respectively. Calculate the common operating voltage of each machine.

A. 220 V B. 222 V C. 223 V D. 218 V

Problem 518:

Three shunt generators operating in parallel supply a total load current of 2000 amperes. Each machine has a field resistance of 40 ohms and an armature resistance of 0.02 ohm. The emfs generated are 240, 242 and 245 volts respectively. Determine current delivered by each generator.

A. 550 A, 600A, 850 A B. 550 A, 650 A, 800 A
C. 500 A, 650 A, 850 A D. 600 A, 600 A, 800 A

Problem 519:

Two shunt generators running in parallel deliver a total current of 3,600 A. Each machine has a field resistance of 60 ohms and an armature resistance of 0.01 ohm. The emfs generated by each machine are 455 and 460 V, respectively. Calculate the kW share of each machine.

A. 652 kW, 1087 kW B. 670 kW, 1069 kW
C. 641 kW, 1098 kW D. 682 kW, 1057 kW

Problem 520:

A shunt generator and a battery are connected in parallel serving a 500 A bus load. The generator has an external characteristics such that the terminal voltage drops uniformly from 460 volts on no- load to 440 volts on rated load while delivering 125 A of current. The battery has an open circuit emf is 420 V and internal resistance of 0.01 ohm. What percentage of the load current does the battery deliver?

A. 53% B. 47% C. 64% D. 36%

Problem 521:

A 50 kW, 220 V DC generator has a voltage regulation of 10%. It is connected in parallel with a battery of 115 cells, each with an emf of 2V and internal resistance of 0.01 ohm. What current will the battery carry if by accident the load is trip- off from the bus?

A. 0 A B. 8.02 A C. 6.15 A D. 7.20 A

Problem 522:

Two identical 600 kW, 230 V dc generators are operating in parallel and take equal shares of an 800 kW, 250 V bus load. The voltage regulation of each machine is 5%. If one of the generators is accidentally tripped off from the line, what is the voltage of the remaining machine?

A. 250 V B. 243 V C. 245 V D. 247 V

Problem 523:

Two 250 V dc generators are operating in parallel and taking equal shares of a 3000 A, 250 V busload. The rating of the generators are as follows:

Machine Parameters	Generator 1	Generator 2
Regulation (%)	2	4
Rated Power (kW)	500	400

If the load drops to 2100 A, determine the new operating bus voltage.

A. 252 V B. 256 V C. 254 V D. 253 V

Problem 524:

Two shunt generators are operating in parallel and taking equal shares of a 2400 A, 230 V busload. The ratings of the generators are as follows:

Machine Parameters	Generator 1	Generator 2
Regulation (%)	3	4
Rated Power (kW)	500	600
Rated Voltage	250	250

If an additional 600- A load is connected to the bus, determine the current delivered by each generator at this condition.

A. 1516 A, 1484 A B. 1525 A, 1475 A
C. 1612 A, 1388 A D. 1655 A, 1345 A

Problem 525:

A simplex lap wound armature has 580 conductors and carries a current of 125 amperes per armature current path. If the flux per pole is 20 mWb. Calculate the electromagnetic torque developed by the armature?

A. 210.64N-m B. 252.72 N-m C. 230.77 N-m D. 207.63 N-m

Problem 526:

A 6-pole lap wound shunt motor takes 300 A when the speed is 500 rpm. The flux per pole is 0.06 Wb and the armature has 870 turns. Neglecting the shunt field current, calculate the brake horsepower of the motor. Assume a constant loss of 4%.

A. 175 B. 168 C. 172 D. 165

Problem 527:

A 220 V shunt motor driving its normal load draws an armature current of 50 A from a 220 V dc source. The armature resistance of this motor including brushes is 0.25 ohm. How much armature current (minimum) will this motor draw from a 200 V dc source when the same load with the field adjusted to maintain the same speed.

A. 55.76 A B. 58.24 A C. 60.12 A D. 63.48 A

Problem 528:

A DC shunt motor has a full load rating of 15 hp, 230 volts, 57.1 amperes, 1400 rpm. The armature circuit resistance is 0.13 ohm and the field circuit resistance is 115 ohms. Neglecting the effect of armature reaction, determine the no-load line current.

A. 6.74 A B. 5.62 A C. 7.45 A D. 8.64 A

Problem 529:

At rated load, a shunt motor draws an armature current of 50 A from a 230 V dc mains while running at 1000 rpm. At no load the armature current drops to 5 A. If the effect of armature reaction has weaken the flux by 2% from no-load to full load, determine speed of the motor at no-load. Assume the armature resistance to be 0.15 ohm.

A. 1202 rpm B. 1221 rpm C. 1122 rpm D. 1010 rpm

Problem 530:

The nameplate rating of a shunt motor is 150 hp, 600 volts, 205 A, 1700 rpm. The resistance of the shunt field circuit is 240 ohms and the total armature circuit resistance is 0.15 ohm. Calculate the speed regulation of the motor.

A. 4.07% B. 4.89% C. 5.25% D. 5.18%

Problem 531:

A Dc shunt motor runs at 600 rpm on a 240-volt supply while drawing a line current of 30 A. Its armature and field resistances are 0.5 Ω and 120 Ω respectively. What resistance should be placed in series with the armature circuit in order to reduce the speed to 400 rpm. Assume no changes in the armature or field current.

A. 2.69 Ω B. 2.41 Ω C. 2.07 Ω D. 2.83 Ω

Problem 532:

A 120-V shunt motor has an armature equivalent of 0.5 Ω and a field resistance of 60 Ω. At full load, the motor takes 10 A and the speed is 1000 rpm. At what speed must this motor maybe driven to deliver 10 A to an external load at 120 V?

A. 1158 rpm B. 1086 rpm C. 1262 rpm D. 1045 rpm

Problem 533:

A belt-driven 150 kW shunt wound DC generator is running at 450 rpm and is supplying full load to a bus bar at 240 V. At what speed will it run if the belt breaks and the machine continues to run taking 8.5 kW from the bus bar? The armature and field resistances are 0.05 ohm and 85 ohms respectively. The brush contact drop is 1.5 volt per brush. Neglect armature reaction.

A. 395 rpm B. 388 rpm C. 402 rpm D. 358 rpm

Problem 534:

A shunt motor draws a current of 40 A from a 120 V source and runs at 1200 rpm at rated load. The armature and field circuit resistances are 0.1 Ω and 60 Ω, respectively. Determine the speed of the motor at half load. Assume a brush drop of 2 V at rated load and 1 V at half load.

A. 1180 rpm B. 1238 rpm C. 1230 rpm D. 1026 rpm

Problem 535:

A DC shunt motor has a full load rating of 15 hp, 230 volts, 57.1 amperes, 1400 rpm. The armature series circuit resistance is 0.13 ohm and the field circuit resistance is 115 ohms. Neglecting the effect of armature reaction, determine the no-load speed.

A. 1392 rpm B. 1264 rpm C. 1441 rpm D. 1380 rpm

Problem 536:

A 220-V shunt motor delivers 40 hp on full load at 950 rpm and has an efficiency of 88%. The armature and field resistances are 0.2 ohm and 110 ohms, respectively. Determine the starting resistance such that the starting armature current does not exceed 1.6 times the full load current.

A 120-V DC motor rated at 5-hp has a full load efficiency of 86%. The field and armature resistances are 60 ohms and 0.75 ohm, respectively. What starter resistance will be required to limit the armature current at starting to 200% of its rated armature current?

A. 1.02 ohms B. 1.12 ohms C. 1.00 ohms D. 1.22 ohms

Problem 538:

A 10-hp 230 V DC motor of 85% full load efficiency is located 450 ft from the supply mains. If the motor’s starting current is 1.75 times the full load current, what is the smallest cross-sectional area of copper wire required when the allowable voltage drop in the feeder at starting is limited to 24 volts?

A. 30 MCM B. 28 MCM C. 26 MCM D. 27 MCM

Problem 539:

The nameplate rating of a shunt motor is 150 hp, 600 volts, 205 A, 1700 rpm. The resistance of the shunt field circuit is 240 ohms and the total armature circuit resistance is 0.15 ohm. If the motor is to be deliver full-load torque at 1,200 rpm, what value of resistance must be added to the armature circuit?

A. 0.833 ohm B. 0.802 ohm C. 0.827 ohm D. 0.862 ohm

Problem 540:

A 120 V shunt motor draws a current of 77 A at rated load. The armature and shunt field resistances are 0.2 Ω and 60 ohms respectively. A multi-tap starter rheostat is inserted in the armature circuit to limit the starting current. If the rheostat has a resistance of 1.732 ohms, determine the percentage tap used such that the starting current will be limited to 150% of its full load value?

A. 60% B. 50% C. 55% D. 45%

Problem 541:

A 10-hp power 220 V Dc shunt motor has an armature and field resistance of 0.25 ohm and 100 ohms respectively. The full load efficiency is 83%. Determine the value of starting resistance in order that the starting will not exceed 200 percent of full-load value.

A. 2.88 Ω B. 2.59 Ω C. 2.15 Ω D. 2.45 Ω

Problem 542:

A 50-HP, 550 V shunt wound motor draws a line current of 4.5 A at no load. The shunt field resistance is 275 ohms and the armature resistance exclusive of brushes, is 0.3 ohm, the brush drop at full load is 2 V. at full load, the motor draws a line current of 84 A. Calculate the efficiency at full load.

A. 92.0% B. 88.5% C. 91.2% D. 89.9%

Problem 543:

A 100-volt shunt motor is developing 6 hp while operating at an overall efficiency of 86%. The armature and shunt field resistances are 0.06 and 50 ohms respectively. Determine stray power losses.

A. 378 W B. 367 W C. 392 W D. 364 W

Problem 544:

The shaft power of a shunt motor is 7.8 hp. It draws 50 A from 120 V. The field winding draws 1.2 A. What is the efficiency of the motor?

A. 94.7% B. 93% C. 96.9% D. 98.2%

Problem 545:

A 500 V shunt motor running at 720 rpm takes an armature current of 50 A. The equivalent armature resistance is 0.4 ohm. What resistance must be placed in series with the armature to reduce the speed to 540 rpm while maintaining the same torque?

A. 2.2 ohms B. 2.6 ohms C. 2.4 ohms D. 2.8 ohms

Problem 546:

A certain shunt motor has an armature resistance of 0.05 ohm. It draws 50 A at a terminal voltage of 120 V. Assume other miscellaneous losses at 1%. Determine the output horsepower of the motor.

A. 8.5 hp B. 7.1 hp C. 6.8 hp D. 7.8 hp

Problem 547:

The armature and field resistances of a shunt machine are 0.2 ohm and 110 ohms respectively. While running as a generator, the generated emf is 250 V at 1200 rpm. If the machine is run as a shunt motor, it takes 4 A at 220 V. At a certain load the motor takes 30 A at 220 V. However on load, the armature reaction weakens the field by 2%. Find the motor speed at this load.

A. 1120 rpm B. 1050 rpm C. 1042 rpm D. 1025 rpm

Problem 548:

A shunt motor, which has a field resistance of 220 ohms and an armature resistance of 0.8 ohm takes 26 A from 260 V supply when running at 500 rpm on full load. In order to control the speed of the motor a 1.2-ohm resistor is connected in series with the armature. Calculate the speed at which the motor will run when supplying full load torque.

A. 438 rpm B. 445 rpm C. 424 rpm D. 472 rpm

Problem 549:

The input and output powers of a 220 V, shunt motor are 30 and 28 kW respectively. The field and armature circuit resistances are 40 ohms and 0.0125 ohm respectively. Determine the efficiency of the motor if the output power is reduced to 10 kW.

A. 83.56% B. 88.67% C. 84.93% D. 86.485

Problem 550:

A 220 V series motor takes 15 A and runs at 700 rpm. The armature resistance including the resistance of the series winding is 0.8 ohm. At what speed will it run if a 2-ohm resistance is connected in series with supply voltage? Assume the motor is taking the same current.

A. 599 rpm B. 601 rpm C. 572 rpm D. 583 rpm

Problem 551:

The equivalent armature resistance of a series motor is 0.1 ohm. When connected across a 110- V mains, the armature takes 20 A and its speed is 1000 rpm. Determine its speed when the armature takes 50 A from the same mains, with the field increased by 10%.

A. 809 rpm B. 954 rpm C. 856 rpm D. 884 rpm

Problem 552:

A 400 V series motor has a field resistance of 0.2 ohm and an armature resistance of 0.1 ohm. The motor takes 30 A of current at 1000 rpm while developing full load torque. What is the motor speed when this motor develops 60% of full load torque?

A. 1302.4 rpm B. 1256.2 rpm C. 1297.6 rpm D. 1135.5 rpm

Problem 553:

A 10- hp, 230- V, 1200 rpm series motor having rated load efficiency of 85.5%. The armature resistance including brushes is 0.3 ohm. The field resistance is 0.25 ohm. Assuming the flux varies directly as the armature current, what value of resistance should be placed in series with this motor when starting, in order that the starting current maybe limited to the value that will exert a starting torque equal to150% of its rated torque?

A. 4.7 ohms B. 4.4 ohms C. 5.1 ohms D. 3.8 ohms

Problem 554:

The field and armature resistance of a 220 V series motor are 0.2 Ω and 0.1 Ω, respectively. The motor takes 30 A of current while running at 700 rpm. If the total iron and friction losses are 350 W, determine the motor efficiency.

A. 90.6% B. 91.5% C. 89.4% D. 92.2%

Problem 555:

A 100- V series motor is used to drive a load through a pulley. This machine has an armature resistance of 0.2 ohm and a series field resistance of 0.25 ohm. When a torque of 25 N-m is applied to the pulley, the speed is 600 rpm. If stray power losses at this load is 300 W, calculate the armature current.

A. 20.62 A B. 21.89 A C. 22.72 A D. 23.41 A

Problem 556:

A 400 V series motor, having an armature equivalent resistance of 0.5 ohm, takes 44 A of current while running at 650 rpm. What is the motor speed for a line current of 36 A?

A. 803 rpm B. 822 rpm C. 812 rpm D. 806 rpm

Problem 557:

The resistance of each of the two coils of a series motor is 0.04 ohm, armature resistance, 0.04 ohm. The motor takes 50 A at 100 V while running at 800 rpm and the coils are in series. What will its speed if the coils are re-connected in parallel while the load torque is doubled?

A. 800 rpm B. 400 rpm C. 200 rpm D. 650 rpm

Problem 558:

On full load, a 500 V series motor takes 100 A and runs at 820 rpm. The armature and series field resistances are 0.1 and 0.04 ohm, respectively. What will be its speed when developing half- full load torque and with a 0.08-ohm diverter connected across the series field winding. Assume flux is proportional to the field current.

A. 1563 RPM B. 1634 rpm C. 1359 rpm D. 1429 rpm

Problem 599:

A 400 V series motor working with unsaturated field is taking 60 A and running at 840 rpm. The total resistance of the motor is 0.1 ohm. At what speed will the motor run when developing half-full load torque.

A. 1193 rpm B. 1202 rpm C. 1167 rpm D. 1352 rpm

Problem 560:

A long shunt compound motor takes a current of 42 A from 230 V source. The generator parameters are: Ra = 0.1 Ω, Rse = 0.2 Ω and rsh = 50 Ω. If the friction and windage losses amount to 400 W, determine the overall efficiency of the machine.

A. 82.24% B. 80.56% C. 81.22% D. 79.53%

Problem 561:

A 230 V, long shunt machine has the following parameters: Ra = 2.0 Ω, Rsh = 460 Ω and Rse = 0.25 Ω. When the machine is run at no-load at its normal speed and rated voltage, the armature draws 0.6 A. Determine the armature current drawn if the machine delivers an output of 5 bhp.

A. 24.35 A B. 21.22 A C. 20.36 A D. 22.83 A

Problem 562:

A 25 hp, 250 V long shunt compound motor takes 5 A when running light and runs at 1150 rpm. Armature resistance, 0.15 Ω, Shunt field resistance, 200 Ω and series field resistance, 0.05 Ω. At rated load the motor takes 86.5 A and runs at 720 rpm. Determine the ratio of torque developed from no-load to full load.

A. 1:26 B. 1:34 C. 1:22 D. 1:38

Problem 563:

A 200 volt shunt motor has an armature and shunt field resistances of 0.15 Ω and 125 Ω, respectively. When running light, it takes 6 A and runs at 1200 rpm. A series winding of 0.05 ohm is added to make it long shunt cumulatively compounded. This winding increases the flux per pole by 25% when the motor is taking its full load current of 100 A. Neglecting armature reaction, solve for the operating speed as a compound motor.

A. 887 rpm B. 890 rpm C. 868 rpm D. 865 rpm

Problem 564:

A 220 V DC motor has an armature resistance of 0.4 ohm, a shunt field resistance of 175 ohms and a series field resistance of 4 ohms. This machine is connected as a short shunt compound motor to 220 V mains. Calculate the power developed by the armature if the armature current is 30 A. neglect the brush drop.

A. 2254.6 W B. 2572.8 W C. 2652.6 W D. 2150.5 W

Problem 565:

The input current to a 220 V, shunt compound motor at no load is 6 A. The shunt field circuit resistance is 220 ohms; the armature resistance is 0.10 ohm and the series field resistance is 0.08 ohm. What is the stray power loss?

A. 1153.31 W B. 1066.22 W C. 1232.54 W D. 1073.25 W

Problem 566:

The pony brake test of an elevator door drive shunt motor, the ammeter and voltmeter measuring the input read 34 A and 220 V. The speed of the motor is found to be 910 rpm and the balance on a 2 ft brake arm read 27.2 pounds. The tare weight of the arm is found to be positive 2.3 pounds. Determine the efficiency of the motor of this load.

A. 87.03% B. 86.05% C. 84.45% D. 88.32%

Problem 567:

In a brake test of an elevator door motor, the ammeter and voltmeter measuring the input read 34 A at 220 V. The speed of the motor is found to be 910 rpm and the balanced on a 0.61 m brake arm reads 11.9 kg. The dead weight of the arm is found to be 1.09 kg. What is the output hp of the door motor?

A. 9.40 hp B. 10.38 hp C. 8.26 hp D. 9.58 hp

Problem 568:

A shunt motor with an armature and field resistance of 0.055 and 32 ohms, respectively, is to be tested for its mechanical efficiency by means of a rope brake. When the motor is running at 1400 rpm, the longitudinal pull on the 6-inch diameter pulley is 57 pounds. The readings of the line ammeter and voltmeter are 35 and 105, respectively. Calculate the efficiency.

A. 77.10% B. 75.32% C. 78.28% D. 79.12%

Problem 569:

A shunt motor was tested by means of a pony brake having a length arm of 3.5 feet and tare weight of 5.7 lbs. The current drawn by the machine from a 240 V line was 50.9 A when the scale reading was 24 lbs and the speed of the motor was 1215 rpm. Calculate the rotational losses of the motor. The armature and shunt field resistances of the machine are 0.25 Ω and 120 Ω, respectively.

A. 674 W B. 692 W C. 620 W D. 705 W

Problem 570:

Calculate the force that will be exerted on the scale in a pony brake test when a 20-hp, 1,400 rpm motor is operating at full load. The length of the brake arm is 3 ft. and the tare weight of the brake is 3.75 lb.

A. 30.45 lbs B. 28.76 lbs C. 21.54 lbs D. 36.33 lbs

TEST 16 – ALTERNATORS

Problem 571:

What is the speed of a 100 kW, 230- volt, three-phase, four –pole, 60 Hz alternator?

A. 450 rpm B. 900 rpm C. 1200 rpm D. 1800 rpm

Problem 572:

A six- pole, 3- phase AC generator has 72 slots, the coil span is 12. What is the pitch factor?

A. 1.000 B. 0.939 C. 0.985 D. 0.966

Problem 573:

A three- phase alternator has 6 slots per pole per phase. Determine the distribution factor.

A. 0.977 B. 0.956 C. 0.963 D. 0.948

Problem 574:

A 30 MVA, 15 kV three- phase alternator will have a per phase nominal impedance of _____

A. 7.5 ohms B. 9 ohms C. 15 ohms D. None of these

Problem 575:

A two- pole three phase 50 Hz Y- connected AC generator has 9 slots per pole and 6 conductors per slot. What is the flux per pole if the voltage on open circuit is 1.1 kV. Assume a coil span of unity.

A. 0.1657 Wb B. 0.1742 Wb C. 0.1507 Wb D. 0.1728 Wb

Problem 576:

A 6- pole, 3- phase, 60 cycle alternator has 12 slots per pole and 4 conductors per slot. The winding is 5/6 pitch. There are 2,500,000 maxwells (0.025 weber) entering the armature from each north pole, and this flux is sinusoidally distributed along the air gap. The armature coils are all connected in series. The winding is wye-connected. Determine the open circuit emf of the alternator.

A. 532.1 V B. 504.2 V C. 512.4 V D. 572.4 V

Problem 577:

A four- pole, three- phase, 50 Hz, star connected AC generator has 24 stator slots. There are 6 conductors per slot and a sinusoidally distributed flux per pole of 63 mWb. Find the terminal voltage on open circuit, if the coil span factor is unity.

A. 546.05 V B. 579.44 V C. 568.48 V D. 558.62 V

Problem 578:

A three- phase, 6- pole, 72 slot armature of a synchronous generator is wound using a two- layer lap coil having 20 conductors per coil with a pitch of 83.33%. The flux per pole is 4,800,000 maxwells. If the rotor of the generator is driven at a speed of 1200 rpm, calculate the induced emf per phase.

A. 5680 V B. 5390 V C. 5564 V D. 5854 V

Problem 579:

A 1 MVA, 11 kV, three- phase wye- connected synchronous generator has a synchronous reactance of 5 ohms and a negligible resistance per phase. At a certain field current the generator delivers rated load at 0.9 lagging power factor at 11 kV. For the same excitation, what is trhe terminal voltage at 0.9 leading power factor full load?

A. 11.6 kV B. 11.4 kV C. 11.3 kV D. 11.5 kV

Problem 580:

A three- phase star connected AC generator is rated at 2.5 MVA, 11 kV, 60 Hz. The generator has a negligible resistance and a synchronous reactance 20 ohms per phase. To what value will the terminal voltage rise when full load at 80% pf lagging is switch-off?

A. 14.2 kV B. 13.5 kV C. 15.3 kV D. 12.7 kV

Problem 581.

A 1200 kVA, 6600-volt, 3 phase Y connected alternator has an effective resistance of 0.40 ohm and a reactance of 6 ohms per phase. It delivers full load current at 0.80 lagging pf at rated voltage. What will be the terminal voltage for the same excitation and load current, if the power factor is 0.80 leading?

A. 4560 V B. 9878 V C. 7898V D. 4250 V

Problem 582

A 2500 kVA, 6600 V synchronous turbo alternator is operating at full load and 0.8 pf lagging. This machine has a synchronous reactance per phase is 10.4 ohms and a negligible resistance. Calculate the percentage voltage regulation.

A. 48.56% B. 42.35% C. 45.84% D. 43.96%

Problem 583

A 50 kVA, 550-volt single phase alternator draws a field current 10 A at rated load. With the same field current, the open circuit emf and short-circuit current are 300 V and 150 A. The ohmic resistance of the armature between terminals is 0.18 ohm. The ratio of effective to ohmic resistance maybe taken as 1.5. Determine the regulation at 0.8 pf lagging.

A. 27.8% B. 26.4% C. 25.5% D. 24.9%

Problem 584

A generator is rated 100 MW, 13.8 kV, and 90% pf. The effective resistance is 1.5 times the ohmic resistance. The ohmic resistance is obtained by connecting two terminals to DC source. The current and voltage are 87.6 A and 6 V respectively. What is the effective resistance per phase?

A. 0.0513 Ω B. 0.0513 Ω C. 0.0513 Ω D. 0.0513 Ω

Problem 585

To get the armature resistance of a 100 MW, 13.8 kV and 90% power factor generator, two terminals are connected to a DC source. The measured current and voltage are 87.6 amperes and 6 volts respectively. What is the DC resistance per phase?

A. 0.0223 ohm B. 0.0342 ohm C. 0.0685 ohm D. 0.0617 ohm

Problem 586:

A 2 MVA, 2.3- kV three- phase Y- connected alternator operates at rated kVA at a power factor of 80%. The dc armature winding resistance between terminals is 0.08 Ω. The field takes 70 A at 125 V from an exciter equipment. Friction and windage loss is 20 kW, iron losses 36 kW and stray load losses are 2.0 kW. Calculate the efficiency of the alternator. Assume the effective armature- winding resistance is 120% of the DC resistance.

A. 94.0% B. 92.1% C. 93.2% D. 89.5%

Problem 587:

Determine the efficiency of a 1500 kVA, 2300 V, 3- phase, Y- connected alternator, which operates at rated output with a power factor of 80%. The DC armature resistance at 70° C between terminals is 0.08 ohm. The field takes 70 A at 120 V from the exciter equipment. Friction and windage losses are 15 kW, iron loss is 35 kW and stray load losses is 1.5 kW. Assume the effective armature winding resistance is 1.5 times the DC value.

A. 94.56% B. 90.31% C. 93.35% D. 92.62%

Problem 588:

A 2500 kVA, three- phase, 60 Hz, 6.6 kV wye-connected alternator has a field resistance of 0.45 Ω and an armature resistance of 0.05 Ω per phase. The field current at full load 0.85 pf, is 200 A. The stray power losses amount to 82 kW. Calculate the efficiency of the alternator at full load, 0.85 pf lagging.

A. 93.7% B. 94.8% C. 95.2% D. 96.3%

Problem 589

A 6.6 kV, Y-connected, 3-phase alternator has a synchronous reactance of 6 Ω per phase and a negligible resistance. At a certain field current the armature is known to induce 5.8 kV per phase. Calculate the maximum power that can be developed by the alternator at this excitation.

A. 12 MW B. 11 MW C. 9.8 MW D. 10 MW

Problem 590

An 11,000 volts three-phase wye-connected turbo alternator has a synchronous reactance of 6 ohms and a negligible resistance per phase. When the field current is 8 A, the open circuit voltage is 12,000 volts. Determine the armature current when alternator developed maximum power.

A. 1456 A B. 1712 A C. 1643 A D. 1566 A

Problem 591

A three-phase, 11 kV wye connected synchronous alternator has a synchronous reactance of 8 ohms per phase but negligible resistance. If the excitation is such that the open circuit voltage is 14 kV, determine the power factor at the maximum output.

A. 0.786 B. 0.772 C. 0.793 D. 0.708

Problem 592

A 3-phase AC generator is supplying power to a load of 3200 kW at 2300 volts and a pf 0f 60%. Assume that the loss of the line, the generator armature and the load is equal to 10% of the load, what would be the savings in watts if the pf were raised to 80%?

A. 100,000 B. 140,000 C. 80,000 D. 230,000

Problem 593

A 3-phase 50 MVA, 13.8 kV, 3600 rpm, 60 Hz grid connected generator with a synchronous reactance of 3.8 ohms per phase operating with a lagging power factor of 0.88 at rated voltage and current. Determine new power factor if the motor current is decreased by 5%.

A. 0.920 B. 0.935 C. 0.907 D. 0.977

Problem 594

A 3-phase 50 MVA, 13.8 kV, 3600 rpm, 60 Hz grid connected generator with a synchronous reactance of 3.8 ohms per phase operating with a lagging power factor of 0.88 at rated voltage and current. If the load decreases such that its prime mover power is decreased by 25% and the rotor current decreases by the same percentage, what will be the new pf?

A. 0.928 B. 0.998 C. 0.987 D. 0.909

Problem 595

A 3-phase 50 MVA, 13.8 kV, 3600 rpm, 60 Hz grid connected generator with a synchronous reactance of 3.8 ohms per phase operating with a lagging power factor of 0.88 at rated voltage and current. If the machine is to provide a lagging reactive power of 40 MVAR and still operating at its rated current, what percent change in the rotor current is required?

A. 10.48% B. 10.24% C. 11.30% D. 12.28%

Problem 596

A three-phase turbo alternator has a reactance of 15 ohms and a negligible resistance, the machine draws an armature current of 250 A at 0.8 pf lagging when running on 12,000 volts infinite busbars. If the steam admission is constant but the emf is raised by 20%, calculate the new operating pf.

A. 0.547 B. 0.586 C. 0.509 D. 0.575

Problem 597

A three-phase, 20 kV, synchronous alternator has a reactance of 10 ohms and a negligible resistance. The machine draws an armature current of 150 A, 0.80 pf lagging. If the steam admission is constant and field current is adjusted raising the induced emf by 25%, determine the value of the new armature current.

A. 442 A B. 452 A C. 421 A D. 433 A

Problem 598

A standby Diesel generator set will have the following loads: inductive load drawing 50 kVA at 0.8 pf ; lighting load drawing 20 kVA at 1.0 pf. At what pf will the generator operate?

A. 0.855 lagging B. 0.872 lagging C. 0.821 lagging D. 0.894 lagging

Problem 599

A 250 V, 30 Hz generator supplies power to a parallel circuit consisting of a 20 hp motor whose efficiency is 90% at 0.80 pf lagging and a second load that draws an apparent power of 7 kVA at unity pf. Determine the system reactive power.

A. 23.582 kVAR B. 12.435 kVAR C. 10.341 kVAR D. 20.384 kVAR

Problem 600

Two 3-phase, 4160 V, 60 Hz alternators are operated in parallel. The total load of the system is 1050 kW at 75% lagging pf. If the alternator A is carrying 700 kW at 80% pf lagging, determine kVAR of alternator B.

A. 401 kVAR B. 405 kVAR C. 411 kVAR D. 408 kVAR

Problem 601

Two alternators A and B are operating in parallel supplying a load drawing 1000 kVA at 0.80 power factor lagging. If alternator A contributes 500 kVA at 0.60 power factor lagging, determine the power factor of alternator B.

A. 0.928 lagging B. 0.852 lagging C. 0.901 lagging D. 0.977 lagging

Problem 602

Two identical three-phase Y-connected alternators A and B share equally a load of 10 MW at 33 kV and 80% lagging pf. The synchronous reactance of each machine is 4 ohms per phase and the armature resistance is negligible. Alternator A has its field excitation adjusted to carry 125 A lagging current, what is the current supplied by alternator B?

A. 96 A B. 97 A C. 98 A D. 95 A

Problem 603

Alternator A (100 kVA, 3-ϕ, 240 V, 60 Hz, 1800 rpm) is operating in parallel with alternator B (125 kVA, 3-ϕ, 240 V, 60 Hz, 1800 rpm). The load of alternator A is 60 kW at 90% pf lagging and the load of alternator B is 80 kW at 70% pf lagging. Determine pf of load.

A. 0.775 lagging B. 0.784 lagging C. 0.893 lagging D. 0.866 lagging

Problem 604

Two 3-phase, Y-connected turbo alternators supply a load of 3000 kW at 6.6 kV and at 0.8 pf lagging. The excitation of machine A is adjusted so that it delivers 150 A at a lagging power factor, and the governors are so set that the load is shared equally between the machines. Determine the operating power factor of machine B

A. 0.726 B. 0.792 C. 0.704 D. 0.768

Problem 605

Two alternators are operating in parallel supplying a common load of 4250 kW at 0.85 power factor lagging. Alternator A contributes 600 kVAR at 0.92 power factor lagging. Solve for the power factor of alternator B.

A. 0.813 lagging B. 0.834 lagging C. 0.804 lagging D. 0.820 lagging

Problem 606

Two Y-connected alternators A and B running in parallel supply the following loads at 3.3 kV:

Load 1: 800 kW at unity pf

Load 2: 600 kW at 0.8 pf lagging

Load 3: 400 kW at 0.707 pf lagging

If alternator A is adjusted to carry an armature current of 150 A at 0.85 pf lagging what is the armature current of alternator B?

A. 208 A B. 180 A C. 200 A D. 190 A

Problem 607

Two AC generators running in parallel supply the following loads: 400 kW at unity pf; 500 kW at 0.9 pf lagging; 600 kW at 0.866 pf lagging. One machine is loaded to 1000 kW at a pf of 0.92 lagging, what is the operating power factor of the second machine.

A. 0.964 lagging B. 0.921 lagging C. 0.932 lagging D. 0.951 lagging

Problem 608

Two alternators are connected in parallel. The total load is 4250 kW at 0.85 pf lagging. Alternator A operates with a load of 2125 kW at 0.707 pf lagging. Determine the kVA load of alternator B.

A. 2245 B. 2078 C. 2185 D. 2410

Problem 609

Sipalay Mines, has two 3-phase, 60 Hz AC generators operating in parallel. The first unit has a capacity of 1000 kVA and the second unit has a capacity of 1500 kVA. The first is driven by a prime mover so adjusted that the frequency fall from 61 Hz at no-load to 59.6 Hz at full load. The second has a different speed-load characteristics, the frequency fall from 61.4 Hz at full load. When these alternators are jointly delivering 2000 kW, what is the load of each generator?

A. 884 kW, 1116 kW B. 867 kW, 1133 kW C. 915 kW, 1085 kW
D. 804 kW, 1196 kW

Problem 610

Two alternators are driven by shunt motors. The shunt motors have speed-load droop characteristics of 3% and 4% respectively. The alternators are in parallel and each carrying 50 kW. There is no automatic speed-load control. An additional 50 kW is switched on. What are the resulting loads of the alternators assuming that the speed-load control of each adjusted?

A. 78.57 kW / 71.43 kW B. 82.51 kW / 67.49 kW C. 75 kW / 75 kW
D. 80.31 kW / 69.69 kW

Problem 611

There are two alternators, 100 kW, 3-phase in parallel are driven by shunt motors whose speed-load characteristics are as follows: Alternator No.1, no-load speed 600 rpm and the full-load speed 530 rpm, while alternator No. 2, no-load speed 590 rpm and full-load speed 550 rpm. For what load will the alternator divide the load equally?

A. 62.45 kW B. 68.78 kW C. 67.54 kW D. 64.67 kW

Problem 612

There are two alternators, 100 kW, 3-phase in parallel are driven by shunt motor whose speed are driven by shunt motor whose speed-load characteristics are as follows: Alternator No.1, no-load speed 600 rpm and the full-load speed 530 rpm, while alternator No.2, no-load speed 590 rpm and full-load speed 550 rpm. What is the greatest load that can be delivered without overloading either alternator?

A. 171.43 kW B. 168.78 kW C. 177.54 kW D. 164.67 Kw

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Problem 613

The maximum flux density in the core of a 3000/240-V, 50 Hz single-phase distribution transformer is 1.25 Tesla. If the voltage induced per turn is 8 volts, determine the cross sectional of the core in cm^2.

A. 292 B. 375 C. 288 D. 362

Problem 614

The net cross section of a transformer is 20 square inches. The maximum flux density is 11 kilogausses. The frequency is 60 Hz. If there are 1,000 turns in the primary, determine the primary induced emf.

A. 3780 V B. 3945 V C. 3590 V D. 3850 V

Problem 615

Calculate the total magnetic flux in a 60-cycle transformer in which the induced emf per turn of the winding is equal to 2 V.

A. 7.50 mWb B. 7.02 mWb C. 7.50 mWb D. 7.42 mWb

Problem 616

The low side of a certain welding transformer has 2 turns and delivers 300 A. if the high voltage side has 30 turns, how much current flows through it?

A. 10 A B. 12 A C. 20 A D. 15 A

Problem 617

A single-phase transformer is rated 4,160 V primary and 250 V secondary. It has 1,500 turns in the primary and a voltage regulation of 8%. What should be the number of turns in the secondary winding?

A. 88 turns B. 92 turns C. 90 turns D. 86 turns

Problem 618

The current densities in the primary and secondary windings of a step down transformer are 1250 and 1500 A per square inch, respectively. The ratio of transformation is 10:1 and the mean length per turn of the primary is 15% greater than that of the secondary. If the primary winding resistance is 20 ohms, calculate the resistance of the secondary windings.

A. 0.202 ohm B. 0.219 ohm C. 0.209 ohm D. 0.220 ohm

Problem 619

A certain transformer has a ratio of 8 is to 1. The primary winding resistance is 0.00283 ohm per turn and has 1155 more turns than the secondary winding. If the copper losses in the primary is 20% less than in the secondary, find resistance of the secondary winding.

A. 0.073 ohm B. 0.090 ohm C. 0.068 ohm D. 0.084 ohm

Problem 620

A 10 kVA, 2400/240-V single-phase transformer has the following resistances and reactances. Find the primary voltage required to produce 240 V at the secondary terminals at full load, when the power factor is 0.8 lagging.

$R_1 = 3\ \Omega$, $X_1 = 15\ \Omega$ $R_2 = 0.03\ \Omega$, $X_2 = 0.150\ \Omega$

A. 2450 V B. 2572 V C. 2496 V D. 2632 V

Problem 621

A 10-kVA, 2,000/400 V single-phase distribution transformer has a primary and any secondary winding impedance of 5.0 + j 10 and 0.2 + j 0.45 ohms, respectively. Calculate the voltage across the secondary terminals at full load, 80% power factor lagging, when the primary is supplied with 2,000 volts?

A. 400 V B. 394 V C. 385 V D. 379 V

Problem 622

A single-phase transformer rated 75 kVA, 8000 volts primary 240 volts secondary, is given the short circuit test. With the secondary terminals short-circuited, 440 volts (60 Hz) is impressed on the primary, which then draws rated current and 1125 watts. Solve for the percentage impedance of the transformer.

A. 5.29% B. 4.93% C. 5.50% D. 5.13%

Problem 623

A short circuit test was performed upon a 10-kVA, 2300/230 volt transformer with the following results: $E_{SC} = 137$ volts; $P_{SC} = 192$ W; $I_{SC} = 4.34$ A. Calculate in primary terms the reactance of the transformer.

A. 31.56 ohms B. 29.88 ohms C. 10.19 ohms D. 12.45 ohms

Problem 624

A single-phase, 25 kVA, 4800/240 volt transformer was given a short circuit tests: With the secondary terminals short-circuited, 93.75 volts was applied on the primary so that the ammeter reads rated current and the wattmeter reads 162.74 watts, all on the primary side. Solve for the percentage resistance of the transformer.

A. 1.95% B. 3.39% C. 3.02% D. 2.23%

Problem 625

The following data were obtained when a short circuit test was performed upon a 100 kVA, 2400/240 volts distribution transformer: E_{SC} = 72 volts; I_{SC} = 41.6 A; P_{SC} = 1,180 W. All instruments are on the high side during the short circuit test. Calculate the equivalent resistance and reactance of the transformer.

A. 0.682 Ω, 1.59 Ω B. 0.682 Ω, 1.73 Ω C. 0.752 Ω, 1.73 Ω D. 0.752 Ω, 1.59 Ω

Problem 626

A 13.8 kV/480 V, 10 MVA three-phase transformer has 5% impedance. What is the impedance in ohms referred to the primary?

A. 0.952 ohm B. 0.03 ohm C. 5.125 ohms D. 9.01 ohms

Problem 627

A short circuit test was performed on a 20 kVA, 2000/200 V single-phase transformer. With the secondary winding short-circuited, full load current flows in the primary winding with 100 V applied on it. The wattmeter connected in the primary read 300 W. Determine the terminal voltage on full load unity pf.

A. 198.6 V B. 193.4 V C. 196.7 V D. 195.2 V

Problem 628

The following data were obtained when a short circuit test was performed upon a 100 kVA, 2400/240 volts distribution transformer: E_{SC} = 72 volts; I_{SC} = 41.6 A; P_{SC} = 1,180 W. All instruments are on the high side during the short circuit test. Calculate the percent regulation at a power factor of 0.75 lagging.

A. 2.54% B. 2.86% C. 2.62% D. 2.71%

Problem 629

A 200-kVA transformer with impedance of 5% and the power factor of the load is 85%. The primary voltage is 6,000 volts while the copper loss is 5 kW. Find the percentage regulation.

A. 5.03% B. 5.21% C. 4.43% D. 4.03%

Problem 630

A 150 kVA, three-phase transformer supplies 100 kVA at 50% lagging power factor. The transformer's winding impedance is 2% resistance and 5% reactance., based on 150 kVA. Determine the voltage regulation of the transformer at this load. Assume 100% voltage.

A. 3.55% B. 5.33% C. 4.24% D. 4.05%

Problem 631

A short circuit test was performed upon a 10-kVA, 2300/230 volt transformer with the following results: E_{SC} = 137 volts; P_{SC} = 192 W; I_{SC} = 4.34 A. Calculate the percent regulation at a lagging power factor of 0.707.

A. 5.28% B. 5.55% C. 5.37% D. 5.72%

Problem 632

A 100 kVA, 6600/600 V, 60 Hz single-phase transformer operating at rated condition has the following losses: hysteresis loss = 520 W; eddy current loss = 370 W and copper loss = 2000 W. if this transformer is to be used on a 50 Hz system, determine its new kVA rating. Assume the same total losses and maximum core flux.

A. 83.8 B. 94.3 C. 87.4 D. 91.8

Problem 633

When 120 V, 60 Hz is applied to the primary winding of a transformer, the core loss is 240 W. When 50 V, 25 Hz is applied the core loss is 50 W. Determine the core loss when 230 V, 50 Hz is applied to the primary winding.

A. 703.5 W B. 942.6 W C. 863.6 W D. 874.7 W

Problem 634

The eddy current and hysteresis losses of a 4,400-V, 60-Hz single-phase distribution transformer are 280 and 560 watts, respectively. Determine the core loss when the transformer is connected across a 4,600-volt, 50-Hz source.

A. 977 W B. 983 W C. 994 W D. 967 W

Problem 635

In a 400 V, 50 c/s transformer, the total iron loss is 2500 W. When the supplied p.d. is 220 V at 25 c/s, the corresponding loss is 850 W. Calculate the eddy current loss at normal frequency and p.d.

A. 2337 W B. 2165 W C. 2010 W D. 2216 W

Problem 636

When a 220 V, 60 Hz is impressed on a certain transformer at no load, the total core loss is 200 W. When the frequency of the impressed voltage is changed to 25 Hz and the magnitude of the voltage is made such as to maintain the same maximum flux density as before, the core loss falls to 75 W. Calculate the hysteresis losses at 60 Hz.

A. 163 W B. 166 W C. 171 W D. 169 W

Problem 637

A 100-kVA, 4160/230 V, 60 Hz single-phase transformer has percentage impedance of 1.75 + j 4.0. its efficiency when operating at rated conditions at 75% pf lagging is 97%. Determine the efficiency, if the transformer is loaded at rated load and voltage but at 50 Hz. Assume the ratio of eddy current losses to hysteresis losses at 60 Hz to be 2.5.

A. 97.13% B. 96.97% C. 97.61% D. 96.42%

Problem 638

The full load copper loss of a 75 kVA single-phase transformer is thrice the iron losses. At half load unity pf, the efficiency is 97%. Determine the full load efficiency at 0.8 pf lagging.

A. 95.77% B. 98.45% C. 94.78% D. 97.86%

Problem 639

A 50 kVA, 2300/230 volt, 60-cycle transformer is tested in the laboratory so that its characteristics maybe determined. The standard test requires an open circuit test and short circuit test.

Open circuit test l = 6.5 A E = 230 V P = 187 W
Short circuit test l = 21.7 A E = 115 V P = 570 W

Determine the efficiency of the transformer at half load, unity pf.

A. 97.55% B. 98.70% C. 98.45% D. 97.80%

Problem 640

The iron loss of a 25-kVA, 60 Hz single-phase distribution transformer is 1% of the rated output at unity power factor and the full load copper loss is 360 W. Determine the efficiency when operating one half of the rated output at 70% power factor lagging.

A. 95.33% B. 97.82% C. 94.24% D. 96.26%

Problem 641

Given that full load copper losses are exactly twice the iron losses in a 50-kVA transformer, and that the quarter load efficiency is 96.5%. Calculate the full load efficiency at unity power factor.

A. 97.48% B. 98.12% C. 97.64% D. 96.25%

Problem 642

A 15 kVA, 2300/230-volt transformer is under test. With the low side supplied with rated voltage and the high side open circuited, input power through a wattmeter reads 245 W. With the high side supplied with 65 V

while the side short circuited, input power at rated current reads 350 W. Determine the maximum efficiency that can be expected from this transformer at unity pf.

A. 97.29% B. 96.25% C. 97.83% D. 98.21%

Problem 643

A 10-kVA, 2300/230 transformer has an equivalent resistance referred to the secondary winding of 0.05 ohm. The core loss of this transformer is 75 W. At what kVA load will this transformer operate at maximum efficiency?

A. 8.17 kVA B. 9.08 kVA C. 9.32 kVA D. 8.90 kVA

Problem 644

The core loss of a 5 kVA single-phase transformer with normal voltage applied to the primary is 75 watts. The maximum efficiency of the transformer of 0.80 power factor?

A. 95.16% B. 93.38% C. 89.52% D. 91.36%

Problem 645

A 100-kVA transformer has 94% efficiency at full load and 50% full load with unity pf in both cases. Determine the maximum efficiency of the transformer at unity pf load.

A. 96.27% B. 95.68% C. 93.44% D. 94.32%

Problem 646

A 100-kVA transformer has a maximum efficiency of 98% at 10% underload and at unity pf. Evaluate the efficiency at quarter load, 0.80 pf lagging.

A. 96.3% B. 95.3% C. 94.7% D. 97.7%

Problem 647

A 1 MVA, 66/11 kV, 60 Hz transformer has an equivalent series impedance of 1.0 + j 5 ohms referred to the low voltage side and a no-load loss of 5500 watts at rated terminal voltage. What is the maximum efficiency at 0.8 pf lagging?

A. 98.34% B. 97.42% C. 98.02% D. 96.38%

Problem 648

The all day efficiency of a 10 kVA single-phase transformer is 94.7% when loaded as follows: full load unity pf for 4 hrs and a no load the rest of the day. If the full load copper loss at unity pf is 400 watts, calculate the core loss.

A. 75 kW B. 70 kW C. 72 kW D. 78 kW

Problem 649

A 25 kVA distribution transformer operates at 20% overload, 0.3 pf lagging for 1 hour; at full load, 0.9 lagging pf for 3 hours, 50% load at unity pf for 8 hours; and 10% load at 0.8 leading pf for the rest of the day. If core loss is 150 watts and full load copper loss is 500 W, what is the all day efficiency of the transformer?

A. 94.23% B. 92.86% C. 97.14% D. 96.68%

Problem 650

Find the all-day efficiency of a transformer having a maximum efficiency of 98 percent at 15 kVA at unity pf and loaded as follows: 12 hours ----2 kW at 0.5 pf lagging; 6 hours ---- 12 kW at 0.8 pf lagging; 6 hours ---- at no-load.

A. 95.3% B. 91.7% C. 94.6% D. 93.3%

Problem 651

A 30 kVA, 2400/240 V, 60 Hz transformer has a full load power of unity over the period of 24 hours. The maximum efficiency is 95% and it occurs at full load. Calculate the all-day efficiency if loaded as follows: 6 hours at full load and 6 hours at quarter load.

A. 91.53% B. 92.45% C. 90.37% D. 93.86%

Problem 652

A 1000 kVA, 6600/400 volts, 60 cycle single phase core type transformer has the following average daily load: full load at 0.8 pf for 8 hrs; half load at 0.707 pf for 10 hrs; no-load for 6 hrs. Calculate the ratio of full load copper loss to the iron loss for the transformer to be most economical for the above loading.

A. 2.05 B. 3.09 C. 2.17 D. 2.28

Problem 653

The full load copper loss and iron loss of a 75 kVA transformer are equal to 1 kW. During a given day, the transformer is loaded as follows: full load at unity pf for 8 hours, one-half load at unity for 8 hours and no-load the rest of the day. Calculate the all day efficiency.

A. 96.36% B. 97.23% C. 96.47% D. 98.32%

Problem 654

A 6.9 kV/600 V, multi-tap, single-phase distribution transformer is connected to the far end of a distribution line for which the rear end voltage is maintained at 6.9 kV. The equivalent impedance of the transformer referred to low voltage side is 0.05 + j0.25 Ω per phase. The impedance of each line is 1 + j2 Ω. It is required to maintain a terminal voltage of 600 V when the line current of 300 A at 80% pf lagging is delivered to the load. What approximate percentage tapping is required in the primary side? Neglect changes in impedance due to changes in turns ratio.

A. 94% B. 92% C. 90% D. 88%

Problem 655

A 60 Hz alternator generates a single-phase voltage of 120 V and has a reactance of 0.25 ohm. The alternator feeds a line, which is essentially resistive with an impedance of 0.1 ohm. The line is terminated with a 2:1 step up transformer. What should be the load impedance to be connected to the secondary side to have maximum power factor transfer to it?

A. 0.5 + j 1.2 B. 0.4 – j 1.0 C. 0.5 – j 1.2 D. 0.4 + j 1.0

Problem 656

A transformer consist of a primary winding with 500 turns and two secondary windings of 125 turns and 36 turns. The 125-turn secondary winding has 60 ohms connected to its terminals and the 36-turn secondary winding has 3 ohms connected to its terminals. If the primary is connected to a 120-V, 60 Hz source, determine the current in the primary windings.

A. 0.332 A B. 0.412 A C. 0.235 A D. 0.257 A

Problem 657

A 3-phase, 60 Hz transformer has primary, secondary and tertiary windings. The primary winding is delta connected and rated 6,600 V. The secondary winding is delta connected and rated 1000 V. The tertiary winding is wye connected and rated 440 V. If the secondary winding has a 3-phase balanced load of 100 kVA at 80% pf lagging and the tertiary winding has a balanced 3-phase load of 50 kW at unity pf, what is the current in the primary winding and its operating pf?

A. 12.52 A, 0.908 B. 7.23 A, 0.902 C. 12.52 A, 0.902 D. 7.23 A, 0.908

Problem 658

A 20-kVA, 500-V load is to be supplied by an ideal step-up autotransformer from a 400-V source. Find the current in the common winding.

A. 30 A B. 40 A C. 50 A D. None of these

Problem 659:

The two windings of a 10-kVA, 2300/230 volt, distribution transformer is connected in series to form an autotransformer giving a small reduction to potential difference from a 2300-volt line. Determine its kVA rating as an ideal autotransformer, operating in the above conditions.

A. 10 kVA B. 100 kVA C. 110 kVA D. None of these

Problem 660:

A 10 kVA, 440/110 volt, single-phase transformer has an efficiency of 96% at a rated load of unity power factor. The full load copper loss is 250 watts. If this transformer is to be converted as a 550/440-volt autotransformer, determine its efficiency when supplying full load at 85 percent power factor.

A. 99.25% B. 99.03% C. 97.45% D. 98.61%

Problem 661:

What should be the kVA rating of each two transformers in an open- delta bank when the three- phase balanced load is 290.4 kVA?

A. 155.60 kVA B. 173.40 kVA
C. 150.25 kVA D. 167.66 kVA

Problem 662:

A V or open- delta connected transformer bank, composed of two identical units serves a balanced three-phase load of 16 kVA at 230 volts. Solve for the minimum size in kVA of the transformers needed.

A. 8 kVA B. 9.24 kVA C. 16 kVA D. 8.25 kVA

Problem 663:

A V (open- delta) connected transformer bank serves a balanced 3- phase load of 40 kVA at 230 V and 0.866 pf lagging. Solve for the minimum kVA of each transformer needed to accommodate the load without overloading.

A. 25 B. 24 C. 23 D. 20

Problem 664:

Two single- phase distribution transformers are bank in V (open delta). If each transformer is rated 37.5 kVA, solve for the maximum three- phase load that the bank can carry without overloading, considering that the load has a power factor of 0.85 lagging.

A. 52.5 kW B. 49.5 kW C. 53.6 kW D. 55.2 kW

Problem 665:

An open- delta bank, consisting of two single- phase transformers is operating with a balanced three- phase load of 50 kVA, 440 V at 0.8 pf lagging and a single- phase load of 10 kW resistive connected across c-a leg. Determine the minimum ratings of the two transformers. Assume a phase sequence of a-b-c.

A. 38.80 kVA, 34.06 kVA B. 34.32 kVA, 33.40 kVA
C. 35.48 kVA, 36.34 kVA D. 30.83 kVA, 39.52 kVA

Problem 666:

Two (2) single- phase distribution transformers, connected in open- delta will supply power to a 200 hp, 3-phase induction motor, operating at 0.70 power factor and 0.90 efficiency. Solve for the minimum size in kVA of each transformer needed to supply the power without being overloaded.

A. 136.73 kVA B. 124.45 kVA
C. 130.38 kVA D. 129.48 kVA

Problem 667:

The Utility Company supplies two single- phase transformers banked in open delta. If each transformer is rated 75-kVA capacity, what is the maximum 3- phase load in kilowatts that the bank can carry without suffering overload considering that the load has a lagging power factor of 0.80.

A. 104 kW B. 112 kW C. 130 kW D. 114 kW

Problem 668:

Two identical 1- phase transformers connected in open delta will serve a three- phase motor load of 250 hp, 0.70 pf lagging, 0.90 efficiency. Solve for the minimum size in kVA of each transformer required to serve the load without overloading.

A. 150.33 B. 170.91 C. 160.43 D. 185.13

Problem 669:

An open- delta connected transformer bank serves a balanced 3- phase load of 40 kVA at 230 V and 0.866 pf lagging. Solve for the real power and pf at which each transformer is operating.

A. 11.54 kW at 0.5 pf, 23.09 kW at unity pf
B. 12.22 kW at 0.5 pf, 22.42 kW at unity pf
C. 11.54 kW at 0.866 pf, 23.09 kW at 0.707 pf
D. 12.22 kW at 0.866 pf, 22.42 kW at 0.707 pf

Problem 670:

An open- delta, three- phase transformer consisting of two single- phase transformers is operating with a balanced three- phase load of 50 kVA, 440-V at a lagging pf of 0.8. Determine the operating pf of each transformer.

A. 0.393 lagging, 0.993 lagging B. 0.383 lagging, 0.887 lagging
C. 0.383 lagging, 0.993 lagging D. 0.393 lagging, 0.887 lagging

Problem 671:

Two single- phase transformers are connected in V (open delta) and serving a delta connected impedance load, each impedance is equal to $16 \angle 36.87^0$ ohms. If the transformer voltages impressed on the impedances are:

$V_{ab} = 240 \angle 0^0$, $V_{ab} = 240 \angle 240^0$, $V_{ab} = 240 \angle 120^0$ volts

Solve for the kVA delivered by each transformer.

A. 7.28, 5.20 B. 5.87, 6.61 C. 6.84, 5.64 D. 6.24, 6.24

Problem 672:

Two single- phase transformers in an open delta bank served a three- phase balanced load of 290.4 kVA. If a third transformer is added for delta operation, what percent increase in load does this represent?

A. 73.2% B. 84.6% C. 80.5% D. 79.4%

Problem 673:

Three single- phase transformers each rated 75 kVA are banked in delta and supplying a three- phase load drawing 160 kVA at 0.8 lagging power factor. If one transformer is removed for repairs, solve for the amount of overloading of the remaining units.

A. 30 kVA B. 10 kVA C. 20 kVA D. 25 kVA

Problem 674:

A 6600- volt, 60- Hz, 2- phase network is connected to a three- phase, 4- wire system by a Scott- connected transformer combination. If there are 1500 turns on the two- phase side, calculate the number of turns on the three-phase side required for the main and teaser transformers. Voltage per phase on the 3-phase side is 240 V.

A. 94 turns, 83 turns B. 93 turns, 84 turns
C. 95 turns, 82 turns D. 92 turns, 85 turns

Problem 675:

A balanced three- phase transformer bank has delta- connected primary and wye- connected secondary windings. The primary to secondary winding voltage ratio is 2400/277. Solve for the primary line current if the low-side (secondary) load draws a line current of 1000 A.

A. 200 A B. 115 A C. 150 A D. 175 A

Problem 676:

A three- phase 150 kVA, 4160 V, 0.8 lagging pf load is to be supplied by three single- phase transformers having a turns ratio of 2. Calculate the current that flows in the primary windings if the transformers are connected delta-delta.

A. 10.41 A B. 6.01 A C. 20.82 A D. 12.02 A

Problem 677:

What should be the turns ratio of a three phase transformer to transform 10,000 kVA from 230 kV to 4160 V if the transformer is to be connected Δ - Y ?

A. 94 B. 98 C. 96 D. 97

Problem 678:

A bank of three 50:1 single- phase transformers connected Y-Δ is used to step down the HV transmission line rated 138 kV. Determine the magnitude of the step down voltage.

A. 126 kV B. 6.90 kV C. 138.55 kV D. 159.35 kV

Problem 679:

The potential transformer of a line has a ratio 132,000/66. These are connected wye- delta. The voltmeter reads 64 volts. What is the voltage of the line?

A. 221.7 kV B. 112.5 kV C. 135.2 kV D. 132 kV

Problem 680:

A power transformer rated 50,000 kVA, 34.5 kV/13.8 kV is connected wye- grounded primary and delta on the secondary. Determine the full load phase current on the secondary side.

A. 2092 A B. 1725 A C. 1449 A D. 1208 A

Problem 681:

A 69/13.8 kV, 10 MVA three- phase transformer is connected wye- grounded delta. What is the kV rating of the secondary winding?

A. 7.97 B. 15 C. 23.9 D. 13.8

Problem 682:

The PTs of a 220 kV transmission line have ratio of 132.76 kV/66.375 kV and are connected wye-wye. A voltmeter connected line to ground reads 66 volts. What is the transmission line voltage?

A. 228.63 kV B. 220.10 kV C. 223.15 kV D. 225.25 kV

Problem 683:

A power transformer rated 50,000 kVA, 34.5 kV/13.8 kV is connected wye-wye. What are the line currents at full load?

A. 525.2 A, 1725.4 A B. 836.7 A, 2092 A
C. 483.1 A, 1207.7 A D. 1449.3 A, 3623.2 A

Problem 684:

Two transformers are connected in parallel to supply a common load of 175 kVA. Transformer A is rated 100 kVA with equivalent impedance of 9.6 ohms while transformer B is rated 75 kVA with equivalent impedance of 12.5 ohms. Find the kVA load of each transformer.

A. 78,97 B. 76,99 C. 80,95 D. 75,100

Problem 685:

Two distribution transformers are connected in parallel supplying a load of 125 kVA. If transformer A ia rated 50 kVA, with 14 ohms equivalent reactance and transformer B is rated 75 kVA with 11 ohms equivalent reactance. Solve for the loading in kVA of each transformer.

A. 55 kVA, 70 kVA B. 50 kVA, 75 kVA
C. 58 kVA, 67 kVA D. 52 kVA, 73 kVA

Problem 686:

A 125- kVA distribution transformer with 4% impedance is connected in parallel with another transformer rated 75-kVA and with 3% impedance. Both have the same voltage ratio. Neglect resistance of each transformer. The total load is 140 kVA at 85 percent power factor. How much load does each carry?

A. 80.5 kVA/ 59.5 kVA B. 77.78 kVA/ 62.22 kVA
C. 80 kVA/ 60 kVA D. 87.50 kVA/ 52.5 kVA

Problem 687:

Two parallel transformers have 8% reactance each. One is rated 25 MVA and the other at 15 MVA. For a given 30 MVA load with a lagging pf of 0.8, determine the load carried by each transformer?

A. 18.50 MVA, 11.50 MVA B. 18.75 MVA, 11.25 MVA
C. 15.25 MVA, 14.75 MVA D. 16.45 MVA, 13.55 MVA

Problem 688

A 500-kVA single-phase transformer "A" with percentage impedance of 0.010 +j0.05 is connected in parallel with a 250-kVA transformer "B" with percentage impedance of 0.015 + j0.04. If the transformers are serving a single-phase load rated 800-kVA, 80% lagging pf, determine the operating pf of each transformer. Assume the transformers have the same turn ratio.

A. A = 0.762, B = 0.803 B. A = 0.772, B = 0.856
C. A = 0.762, B = 0.856 D. A = 0.772, B = 0.803

Problem 689

The MERALCO has two single-phase transformers with equal turns ratio and ratings and are operated in parallel to supply a load of 280 kW at 0.80 lagging pf. Transformer A has a resistance of 2% and a reactance of 8%. Transformer B has a resistance of 1% and a reactance of 6%. Determine the power delivered by the transformer A and B to the load.

A. A = 123 kW, B = 157 kW B. A = 125 kW, B = 155 kW
C. A = 122 kW, B = 158 kW D. A = 127 kW, B = 153 kW

Problem 690

Two single-phase transformer with equal ratings and turns ratio are operated in parallel to supply a load of 180 kW at a lagging pf of 0.90. Transformer A has a resistance of 1 % and a reactance of 6%. Transformer B has a resistance of 2% and a reactance of 5%. Calculate the power delivered by each transformer.

A. 83 kW, 97 kW B. 79 kW, 101 kW C. 88 kW, 92 kW D. 80 kW, 100 kW

Problem 691

Two single-phase transformers A and B are connected in parallel to serve a 600-A single-phase load at 0.80 pf lagging. The equivalent impedance of the transformers are 2 + j3 and 2.3 + j 5 ohms, respectively. Determine the ratio of the kW output of transformer A to the kW output of transformer B. Assume the transformer have equal ratings and turns ratio.

A. 1.56 B. 1.88 C. 1.68 D. 1.74

TEST 19 – 3- PHASE INDUCTION MOTORS

Problem 692:

A single phase induction motor is rated 5 hp, 75% power factor and 220 volts. What is its full load current?

A. 22.5 A B. 20.5 A C. 16.9 A D. 18.5 A

Problem 693:

A 5 hp, 3- phase motor draws current when connected to 230 V. Determine the current drawn by the motor if the power factor is 0.90 and efficiency of 83%.

A. 12.53 A B. 15.13 A C. 13.25 A D. 14.05 A

Problem 694:

A 3- phase motor is rated 750 hp at 460 volts line to line, 0.85 pf lagging and 0.95 efficiency. Solve for the rated current.

A. 869.64 A B. 702.23 A C. 405.43 A D. 917.32 A

Problem 695:

A 40 hp, 3- phase, 4- pole, 230- volt, 60 Hz induction motor operating at 0.90 efficiency, 0.85 power factor and 3% slip, drives a water pump. Determine the current at which the motor is operating.

A. 94.531 A B. 96.234A C. 97.915 A D. 93.351 A

Problem 696:

Calculate the speed of a 60- cycle, 14- pole motor if the slip is 5%.

A. 514.29 rpm B. 488.57 rpm C. 456.32 rpm D. 429.63 rpm

Problem 697:

The rotor speed of a 6- pole, 50- cycle induction motor is 960 rpm. Calculate the percent slip.

A. 5% B. 2% C. 4% D. 3%

Problem 698:

What is the speed of an induction motor of six poles if the percent slip is 2.5%?

A. 1462 rpm B. 1170 rpm C. 877 rpm D. 1755 rpm

Problem 699:

A squirrel cage induction motor with nameplate data of: 150 hp, 3- phase, 460- V, 60 Hz, 6- pole, 0.85 pf, was subjected to certain performance tests. The test results readings were as follows:

Full load current = 202 A

Full load torque = 676.8 lb-ft.

Solve the percentage slip.

A. 3.28% B. 4.15% C. 3.05% D. 2.25%

Problem 700:

A six- pole, three- phase squirrel- cage induction motor is connected to a 60- cps supply. At full load, the rotor's induced emf makes 72 complete cycles in 1 minute. Find the rotor speed.

A 1176 rpm B. 1200 rpm C. 1054 rpm D. 1124 rpm

Problem 701:

A 50- hp, three- phase motor, rated 220 V, 75% power factor has 6 poles. The slip at full load is 3%. What is the frequency of the rotor current at full load?

A. 1.8 Hz B. 60 Hz C. 5.4 Hz D. 58.2 Hz

Problem 702:

A 150- hp, 3- phase, 6- pole, 460 V, 60 Hz induction motor draws 195 A line current at full load speed of 1170 rpm and 0.85 pf. Solve for the percent slip at full load.

A. 2.5% B. 3.0% C. 2.8% D. 2.0%

Problem 703:

The deep well pump motor is 50 hp, 3- phase, 4- poles, 230 volts, 60 Hz induction motor, operating at 0.90 efficiency, 0.85 power factor and 3% slip. Determine the current at which the motor is operating.

A. 112.7 A B. 122.4 A C. 120.5 A D. 124.7 A

Problem 704:

The rotor of a 220 V, 60 Hz, 4- pole induction motor has a power input of 80 kW is observed that the rotor emf make 90 cycles per minute. Calculate the rotor copper loss.

A. 2 kW B. 5 kW C. 3 kW D. 4 kW

Problem 705:

An induction motor carries a rotor current per phase of 10 A when loaded until the slip is 5%. If the rotor effective resistance is 0.1 ohm per phase, determine the total power transferred across the air gap per phase.

A. 210 W B. 240 W C. 190 W D. 200 W

Problem 706:

A 10 hp (nameplate), 6- pole, 60 Hz, three- phase induction motor delivers 9.9 hp with an input 9200 watts. The core loss is 450 W. The stator copper loss is 650 watts and the rotational losses is 150 watts. What is the motor speed?

A. 1116 rpm B. 1200 rpm C. 1210 rpm D. 1125 rpm

Problem 707:

A three- phase squirrel cage induction motor is drawing 45 kW from a 440 V, 60- Hz, 3- phase line. If stator losses amount to 900 W, determine total mechanical power developed. Assume a slip of 3%.

A. 40.32 kW B. 44.64 kW C. 48.22 kW D. 42.78 kW

Problem 708:

A 10- hp, 4- pole, 25 Hz, 3- phase induction motor is taking 9100 watts from the line. Core loss 290 watts; stator copper loss is 568 watts; rotor copper loss is 445 watts and the friction and windage loss 121 watts. Determine the output torque in Newton-meters.

A. 108.4 B. 112.5 C. 101.2 D. 103.3

Problem 709:

A 40- hp, 230- V, 8- pole, 25 Hz, three- phase induction motor is running at 355 rpm at rated load. The torque lost by friction is 24 N-m. If total stator losses amount to 1000 W, evaluate the efficiency of the motor at this load.

A 91.42% B. 88.51% C. 90.31% D. 89.17%

Problem 710:

The rotor of 220- V, 60 Hz, 4- pole induction motor has a power input of 80 kW is observed that the rotor emf makes 90 cycles per minute. Calculate the gross mechanical power developed.

A. 72 kW B. 78 kW C. 75 kW D. 77 kW

Problem 711:

A 6- pole, 50 Hz, 3- phase induction motor runs at 960 rpm while delivering a shaft torque of 120 N-m. if friction and windage loss amount to 180 W, determine rotor copper loss.

A. 521 W B. 518 W C. 510 W D. 526 W

Problem 712:

Determine the speed in rpm of the motor at full load with the following circuits elements per phase.

Rotor leakage reactance = 0.65 Rotor resistance = 0.10

Stator leakage reactance = 1.12 Stator resistance = 0.25

Connection = Y-Y

This motor is 500 hp, 3- phase, 2200 volt, 60- cycle, 6- pole induction motor with additional core loss of 2000 watts and the friction and windage losses total is 10,000 watts.

A. 1200 rpm B. 1196 rpm C. 1190 rpm D. 1188 rpm

Problem 713:

A 50- hp, 440 V, 3- phase, 60 Hz, 6- pole squirrel cage induction motor is operating at full load and 0.8 pf. The full load efficiency is 85% and the percentage slip is 5%. Determine full load torque.

A. 214.55 N-m B. 206.72 N-m C. 312.47 N-m D. 323.24 N-m

Problem 714

A 30-hp, 4-pole, 3-phase, 230 volts, 60 Hz squirrel cage induction motor operating at 90% efficiency, 85% power factor and 2.5% slip drives a water pump for a reservoir. Find the current and speed at which the motor is operating.

A. 73.4 A, 1755 rpm B. 62.39 A, 1755 rpm C. 73.4 A, 1800 rpm D. 62.39 A, 1800 rpm

Problem 715

A 50-hp, 4-pole, 3-phase, 230 volts, 60 Hz squirrel cage induction motor has an efficiency of 90%, power factor 85% and a slip of 2% at full load. Find the torque in lb-ft at full load.

A. 152.45 B. 148.87 C. 121.34 D. 150.56

Problem 716

The losses in a 3-phase, 25-Hz, 4-pole induction motor at full load are as follows: core – 3%; Friction and windage – 2%; Stator copper – 4%; and Rotor copper – 2%. At 70% of full load of the machine, determine its efficiency.

A. 90.52% B. 88.15% C. 87.24% D. 89.81%

Problem 717

A 100 hp, 440 volt, three-phase, 60 Hz induction motor operates with 92 percent efficiency, 0.85 power factor, at rated load. What is the current of the motor?

A. 125 B. 115 C. 98 D. 55

Problem 718

A six-pole, three-phase, 440-volt, 60-Hz induction motor develops 10-hp at 1150 rpm, the power factor being 80% lagging. Stator and core losses amount to 400 W and 350 W respectively. Frictional losses amount to 0.5-hp. Calculate motor line current.

A. 12.24 A B. 11.42 A C. 13.41 A D. 14.64 A

Problem 719

A three- phase, 7.5 hp, 220- V, 6- pole, 60- Hz, Y- connected induction motors was tested and give the following results:

No- load test: l = 6.5 A P = 610 W N_r = 1190 rpm
Load test: l = 18.4 A P = 6700 W N_r = 1164 rpm
Resistance test: 0.54 ohm between any two stator terminals

Determine the efficiency of the motor during the load test.

A. 83.45% B. 84.69% C. 85.28% D. 86.55%

Problem 720:

A three- phase wound induction motor, 440 V, 60 cycle, 4- pole is connected to a pump that delivers 1000 cfm of water against an effective head of 8 ft. Under this load the motor, the motor draws 15 kW at a power factor of 0.90. When operated without load, the motor draws 800 watts. The stator resistance per phase is 0.21 ohm. The turns ratio between stator and rotor is 4:1. Determine the efficiency of the pump.

A. 83.62%. B. 84.65% C. 83.16% D. 84.24%

Problem 721:

A three- phase, 6- pole, 60- Hz, Y- connected squirrel cage induction motor operates with a slip of 2% and draws 10 A and 3,500 W at full load. When running light, the motor draws 4.2 A and 300 W. When the rotor of this motor is blocked, the motor draws 450 W, 15 A at 50 V. Calculate the torque exerted when driving its full load.

A. 22.82 N-m B. 24.65 N-m C. 20.36 N-m D. 26.74 N-m

Problem 722:

The following data were obtained from a 5- hp, 110-V, 60 HZ, 8- pole, 3- phase, Y- connected induction motor:

No- load test: l = 10 A W_1 = 725 W W_2 = - 425 W
Load test: l = 28 A W_1 = 3140 W W_2 = 1580 Nr = 870 rpm
DC resistance test: 0.16 ohm between any two stator terminals

Calculate the torque in N-m exerted by the motor during the load test. Assume the AC resistance is 1.25 times the DC resistance.

A. 44.74 B. 52.42 C. 46.10 D. 43.84

Problem 723:

A resistor assembly for a wound rotor consist of 20 elements of cast iron grid elements. The rating of each is 0.10 ohm. When joined in series and tested across 220 volts, the measured current was 100 A. How much power was lost in the joints?

A. 1.9 kW B. 1.8 kW C. 2.0 kW D. 2.1 kW

Problem 724:

A wound rotor motor, 7.5 hp, 230 volts, 3- phase takes a line current of 18.4 amperes, when operating at rated output at an efficiency of 88%. Calculate the indications on wattmeters when these are inserted to measure power by the two-wattmeter method.

A. 4.035 kW, 2.323 kW B. 4.232 kW, 2.126 kW C. 3.902 kW, 2.456 kW D. 3.855 kW, 2.503 kW

Problem 725

Two-wattmeter method is used to test a 25 HP, 230 volt, 1800 rpm, 60-cycle, 3-phase induction motor. When the line voltages are 230 volts, one wattmeter reads + 13,400 watts and the other + 7,400 watts. Determine motor line current.

A. 55.6 A B. 58.4 A C. 52.3 A D. 50.8 A

Problem 726

An induction motor of 30 hp, 220 volts 3-phase draws 450 percent of the rated current with the rated voltage and delivers during the starting period 130 percent of the normal torque. The full load efficiency and full load pf of this motor is 80% and 70% respectively. If an autotransformer is used as a starting unit and starting torque of the load is only 50 percent of the rated torque of the motor, find the starting voltage.

A. 136.44 V B. 130.65 V C. 132.36 V D. 134.20

Problem 727

A 10-HP, 550 V, 60 Hz, 3-phase induction motor has a starting torque of 160% of full load torque and a starting current of 425% of full load current. If the motor is used on a 440 V, 60 Hz system, what will be the starting torque expressed in percent of full load value?

A. 102.4% B. 101.8% C. 104.2% D. 103.5%

Problem 728

A 10-HP, 550 V, 60 Hz, 3-phase induction motor has a starting torque of 160% of full load torque and a starting current of 425% of full load current. What will the voltage in order that the starting current be limited to the full load value?

A. 132.47 V B. 129.41 V C. 125.52 V D. 136.75 V

Problem 729

A 25-hp, 230 V three phase motor with 85% power factor has a starting current of 5.5 times rated current. To reduce the starting current, a wye-delta starter is installed. What shall be the new starting current?

A. 195 A B. 302 A C. 135 A D. 175 A

Problem 730

A squirrel cage motor is started at 50% of its rated voltage. What is the starting torque relative to its rated voltage starting torque?

A. 50% B. 100% C. 25% D. 75%

Problem 731

A delta-connected load induction motor draws 100 A from each line of a three-phase source and develops 40 lb-ft torque at standstill. Find the torque when connected to the same service if the motor is re-connected in wye.

A. 13.3 lb-ft B. 120 lb-ft C. 40 lb-ft D. None of these

Problem 732

An induction motor of 30-HP, 220 V, 3-phase draws 450 percent of the rated current with the rated voltage and delivers during the starting period of 130% of the normal torque. The full load efficiency and full load pf of this motor is 80 percent and 70 percent respectively. If an autotransformer is used as a starting unit and the starting torque of the load is only 50 percent of the rated torque of the motor, find the starting current on the line.

A. 301.4 A B. 292.7 A C. 288.6 A D. 227.3 A

Problem 733

A 7.5 hp, 500 V three-phase motor induction motor is developing its full load output at 960 rpm. The starting torque is equal to the full load torque. What will be the starting torque if the supply voltage falls to 400 volts?

A. 32.34 N-m B. 35.62 N-m C. 28.27 N-m D. 38.82 N-m

Problem 734

The deep well pump motor is 50 hp, 3-phase, 4-poles, 230 volts, 60 Hz induction motor, operating at 0.90 efficiency, 0.85 power factor and 3% slip. Determine the discharge of the pump in cubic meters per minute, assuming that the total head against which the pump is working is 50 meters and the density of water is 1000 kg per cubic meter.

A. 4.103 B. 4.224 C. 4.563 D. 4.205

Problem 735

A three-phase, 230 V, 6-pole, 60 Hz induction motor is loaded by means of a pony brake. The length and dead weight of which are 2.5 ft and 2 lbs respectively. With 230-V impressed on this motor, the total force delivered by the pony brake is 30 lbs. the power input to the meter is measured by two wattmeters using the two-wattmeter method. These wattmeters register 4 and 8 kW respectively. If the motor has a slip of 55 under this condition, determine its efficiency.

A. 93.62% B. 92.44% C. 90.82% D. 94.43%

Problem 736

A 75 kVA, 3-phase transformer supplies the following initial loads: Capacitor bank drawing 25 kVAR and an inductive load drawing 36 kW, 0.715 pf. Determine the maximum hp of induction motor at 0.8 pf and 90% efficiency that can be added to the load without overloading the transformer.

A. 40.2 hp B. 38.4 hp C. 35.5 hp D. 37.5 hp

Problem 737

The feeder of an industrial plant is has a load of 400 kVA at a power factor of 755 lagging. An induction motor load drawing 100 kW is added to the feeder. Determine the operating power factor this motor such that the total feeder load will have a lagging pf of 90%.

A. 0.942 B. 0.894 C. 0.902 D. 0.818

TEST 20 – SYNCHRONOUS MOTORS

Problem 738:

A three-phase Y-connected synchronous motor with a line-to-line voltage of 440 V and a synchronous speed of 900 rpm operates with a power of 9 kW and a lagging power factor of 0.8. The synchronous reactance per phase is 10 ohms. Determine the torque angle in electrical degrees.

A. 36.33° B. 33.51° C. 35.51° D. 38.46°

Problem 739:

A 10-hp, 230-V, three-phase Y-connected synchronous motor has a reactance of 3 ohms per phase and a negligible resistance. To what voltage must the motor is excited in order to deliver full load at unity power factor and 90% efficiency?

A. 262 V B. 254 V C. 248 V D. 242 V

Problem 740:

A 1000 kVA, 11 kV, 3-phase Y-connected synchronous motor has a resistance of 3 ohms and a reactance of 25 ohms per phase. Determine the induced emf when fully loaded at 0.8 power factor lagging.

A. 5521 V B. 5362 V C. 5475 V D. 5582 V

Problem 741:

A 500-hp, 2200 V, 3-phase star connected synchronous motor has a synchronous impedance of 0.3 + j 3 Ω per phase. Determine the induced emf per phase if the motor works on full load with an efficiency of 94% and a power factor of 0.8 leading.

A. 1360 V B. 1354 V C. 1402 V D. 1522 V

Problem 742:

A three-phase, star connected synchronous motor takes 50 kW at 660 V, the power factor being 0.8 lagging. This machine has a synchronous reactance of 1 ohm per phase with an negligible resistance. If the emf is increased by 30%, the power taken remaining the same, find the new leading pf current.

A. 94.1 A B. 85.2 A C. 90.3 A D. 88.6 A

Problem 743:

A 6.6 kV, Y-connected synchronous motor has a synchronous reactance per phase of 10 ohms and a negligible resistance. For a certain load, the motor draws 990 kW at normal voltage. At this load, the induced emf per phase is 5160 V. Determine the operating pf.

A. 0.478 B. 0.502 C. 0.462 D. 0.518

Problem 744:

A 75-hp, 600-volt, 1000-rpm, three-phase Y-connected synchronous motor has an armature resistance of 0.05 per phase and a leakage reactance of 0.45 ohm per phase. The efficiency at rated load, 80% pf leading is 92%. Determine mechanical power developed within the armature.

A. 64 kW B. 62 kW C. 60 kW D. 67 kW

Problem 745:

A 230 V, 60-Hz, 3-phase, Y-connected synchronous motor draws a current of 20 A and delivers 8 bhp. Armature resistance per phase is 0.5 Ω. If the iron and friction losses amount to 300 W, determine the operating power factor of the motor.

A. 0.809 B. 0.807 C. 0.866 D. 0.862

Problem 746:

A 2200 V, 200 hp, 3-phase mesh connected synchronous motor is working on full load at an efficiency 0.88 and 0.8 pf leading. The armature reactance per phase is 5 ohms. Determine the induced emf per phase. Neglect resistance.

A. 2377 V B. 2345 V C. 2380 V D. 2307 V

Problem 747:

A 15-hp, 230 V single-phase synchronous motor is taking a current of 50 A at a power factor of 0.85 leading. Effective armature resistance is 0.2 ohm. If this motor drives a mechanical load of 12 hp, determine its rotational losses.

A. 323 W B. 340 W C. 376 W D. 314 W

Problem 748:

A 440- V, single- phase synchronous motor is drawing a line current of 50 A at 0.9 pf lagging. This machine has an armature resistance and reactance of 0.8 and 10 ohms respectively. If stray power and excitation losses amount to 500 W and 800 W respectively, determine the bhp output of the motor.

A. 23.2 B 20.4 C. 25.8 D. 18.5

Problem 749: EE Board April 1993

A single- phase synchronous motor gives an output of 9.46 kW at 0.9 pf lagging with 600 V. If stray power loss is 600 W and field losses is 900 W, while effective armature resistance is 0.6 ohm, find the efficiency of the synchronous motor.

A. 82.35% B. 81.24% C. 85.25% D. 84.64%

Problem 750:

A 230- V, 60 Hz, single- phase synchronous motor is taking a current of 20 A at 0.866 pf lagging. Effective armature resistance is 0.3 ohm. Iron and friction losses amount to 450 W, determine the efficiency of the motor at this load. Neglect losses in the excitation.

A. 86.15% B. 85.30% C. 88.52% D. 83.20%

Problem 751:

A three- phase star- connected synchronous motor draws 70 A at 0.8 pf leading when connected from a 6.6 kV, 60- Hz, 3- phase source. At this load the machine operates with an efficiency of 90%. If the synchronous impedance of the machine is 2 + j15 ohms, determine the stray power losses.

A. 40.5 kW B. 28.6 kW C. 32.8 kW D. 34.6 kW

Problem 752:

A 20 HP, 440- V, 60- Hz, 3- phase star- connected synchronous motor has an armature resistance per phase of 0.4 ohm. It is giving its full load output at a power factor of 0.9 leading. If the stray power losses amount to 500 W, find the armature current.

A. 23.44 A B. 25.28 A C. 22.53 A D. 20.67 A

Problem 753:

A 500- V, 60- Hz single- phase synchronous motor develops 20 hp and is operating at a pf of 0.8 lagging. Effective resistance of armature is 1 ohm. Iron and friction losses amount to 500 W. Determine power drawn by the motor from the source.

A. 18, 220 W B. 21, 546 W C. 17, 288 W D. 20, 065 W

Problem 754: EE Board April 1991

A three- phase synchronous motor is measured by two A and B wattmeters. It reads 28.6 kW and 46.5 kW, respectively. The input power of the motor is under excited and assumed constant. What are the readings of A and B wattmeters if the power factor is 85% and the motor is over- excited?

A. 48.6 kW, 26.5 kW B. 42.5 kW, 32.6 kW
C. 52.6 kW, 52.6 kW D. 51.10 kW, 24.1 kW

Problem 755:

The input power to a 600- V synchronous motor is measured by means of a two- wattmeter method. One wattmeter reads 64 kW and the other read 36.5 kW. The motor is known to be operating at leading pf. Determine the line current drawn.

A. 104 A B. 110 A c. 107 A D. 112 A

Problem 756:

A group of induction motors rated 2200- V, 3- phase, 60- Hz delivers a total of 600 hp and is operating at an average power factor of 0.8 lagging. If half of this is replaced by a group of synchronous motors operating at an average pf of 0.8 leading, determine the percentage reduction of the line current. Assume all motors operate at an average efficiency of 90%.

A. 23% B. 25% C. 20% D. 21%

Problem 757:

A three- phase transmission line having a capacity of 10, 000 kVA serves a balanced load that draws 5,000 kW at a lagging power factor such that the transmission line is loaded to its capacity. An additional load of induction motors operating at an average pf of 0.8 is connected to the line. In order to make use of the line to its full

capacity in active power, a synchronous condenser having losses of 300 kW will be connected to the line. What is the kVA rating of the synchronous motor required?

A. 11,158 B. 12,189 C. 13,205 D. 10, 202

Problem 758:

A three- phase Y- connected synchronous motor with a line-to-line voltage of 440 V and a synchronous speed of 900 rpm and operates with a power of 9 kW and a lagging power factor of 0.8. The synchronous reactance per phase is 10 ohms. The machine is operating with rotor current of 5 A. it is desired to continue carrying the same load but to provide 5 kVAR of power factor correction to the line. Determine the required rotor current to do this.

A. 7.88 A B. 8.06 A C. 8.62 A D. 8.28 A

Problem 759: EE Board October 1991

A 3,600 volts three- phase star- connected turbo synchronous generator of synchronous reactance of 0.5 ohm per phase and negligible resistance is supplying 30, 000 kVA at 0.8 pf lagging to a large power system. If the steam supply is cut- off, calculate the amount of current that the generator will then carry assuming negligible losses.

A. 3901 A B. 3823 A C. 3094 A D. 3870 A

Problem 760: EE Board October 1994

A wye- connected turbo alternator having a synchronous reactance of 0.5 ohm and negligible resistance is connected to a large power system having a busbar voltage of 13.8 kV supplying a load of 15,000 kVA at 0.80 lagging power factor. If the steam supply is cut- off, the armature current will the machine carry assuming negligible losses?

A. 256.55 A B. 525.62 A C. 384.26 A D. 627.55 A

Problem 761: EE Board October 1994

A 1,000 kVA, 6,600 V wye- connected three- phase alternator having a reactance of 8.8 Ω and a negligible resistance is supplying power to a constant frequency bus bar. The open circuit emf at this instance is 4,311 V per phase. If steam supply is suddenly cut- off, the armature current in amperes is nearest to

A. 57 B. 60 C. 59 D. 56

TEST 21-CONVERTERS & RECTIFIERS

Problem 762:

A single- phase rotary converter has an output voltage of 110 volts. Determine the line current in AC side when the machine delivers a DC output of 50 A. assume the machine is operating with a pf of 0.85 and efficiency of 95%.

A. 70.71 A B. 90.34 A C. 87.57 A D. 82.23 A

Problem 763: EE Board April 1994

In a three- phase synchronous converter, the ratio of the AC voltage to DC voltage is

A. 0.612 B. 1.0 C. 0.50 D. 0.707

Problem 764:

A three- phase rotary converter delivers 150 A at 500 VDC. Determine the current on the AC side if the operating power factor of the machine is 0.8 and the efficiency is 90%.

A. 179 A B. 157 A C. 189 A D. 196 A

Problem 765:

Three single- phase transformers connected delta- delta fed a three- phase rotary converted at 2,300 V. This converter supplies power to a DC load that draws 100 kW at 250 V. if the rotary converter operates at an efficiency of 95% at unity pf, calculate the current in the secondary winding of the transformer bank.

A. 397 A B. 355 A C. 229 A D. 240 A

Problem 766:

An open delta bank is serving a three- phase rotary converter. The converter supplies 175 A of current to a 1.4 ohm dc resistive load. If the machine draws an AC current of 100 A at 0.8 pf lagging, determine minimum size of transformer needed.

A. 15.4 kVA B. 24.7 kVA C. 25.9 kVA D. 19.4 kVA

Problem 767:

A 4- phase star- connected rotary converter operating at 0.90 efficiency and 0.85 power factor is connected across a 220 V, 60 Hz mains and draws 50 A. determine the DC load current.

A. 208.6 A B. 220.54 A C. 216.37 A D. 212.25 A

Problem 768:

The dc output of a six-phase star-connected converter is 500 kW at 400 V. If the pf and efficiency of the machine is 0.866 and 0.92 respectively, determine the ac current drawn from the supply?

A. 762 A B. 740 A C. 732 A D. 729 A

Problem 770:EE Board April 1992

A 500 kW, 600-V DC, 12-phase synchronous converter operates as a direct converter at a full load efficiency of 92% and a power factor of 0.93. Calculate the AC voltage between slip rings and the AC current drawn from a 12-phase transformer fed supply.

A. 112 V, 229 A B. 112 V, 215 A C. 110 V, 229 A D. 110 V, 215 A

Problem 771:

A 4-pole 230-V, 60 Hz, three-phase induction motor directly drives a 6-pole alternator. Determine the output frequency. Assume a slip of 3% in the motor.

A. 90.0 Hz B. 88.4 Hz C. 86.6 Hz D. 87.3 Hz

Problem 772:

A 4-pole, three-phase synchronous motor connected across a 60 Hz supply drives a 6-pole alternator through a belt. If the diameter of the driver and driven pulleys are 6 and 10 inches respectively, determine the operating frequency of the alternator.

A. 53 Hz B. 54 Hz C. 55 Hz D. 52 Hz

Problem 773:EE Board April 1992

A generator is rated 600 kVA, 240 V, 60 cycles, 3-phase, 6-poles and wye-connected. What will be the speed of the driving pulley if the driven and driving pulleys are 1 ft and 2 ft in diameter respectively?

A. 2400 rpm B. 1200 rpm C. 600 rpm D. 900 rpm

Problem 774:EE Board October 1998

The pulley of an old gen-set has a diameter of 20 inches. The belt exerts a pull of 353 pounds on the pulley. The gen-set runs at 900 rpm. What is the approximate kW rating of the gen-set?

A. 75 B. 250 C. 200 D. 37.5

Problem 775:

A 230-V, 3-phase motor belt drives a 50 kW, 250 V DC generator. The motor, belt and generator efficiencies are 0.91, 0.95 and 0.86 respectively. If the motor operates at a pf of 0.866 lagging, determine the current drawn.

A. 189 A B. 195 A C. 192 A D. None of these

Problem 776:

A single-phase motor is connected across a 230-V, 60 Hz supply and draws 30 A at 0.85 pf lagging. This motor drives a 120-V DC generator through direct coupling. If the motor, coupling and generator efficiencies are 0.85, 0.96 and 0.88 respectively determine the current delivered by the generator using the above condition.

A. 35 A B. 32 A C. 38 A D. 48 A

Problem 777:

A 230-V, 60 Hz, 3-phase motor drives a 25 kW, 250 V DC generator through belt and pulley. The motor generator efficiencies are 0.90 and 0.88, respectively. If the motor draws a line current of 98 A at 0.85 pf lagging, how much is the combined efficiency and pulley?

A. 95.12% B. 96.04% C. 95.33% D. 94.81%

Problem 778:EE Board October 1991

A moving coil ammeter, a resistance of 1500 ohms and a diode are connected in series across a 125 V sinusoidal AC supply. The diode has a linear current / voltage characteristics over the range l = 0, E = 0 V to l = 200 mA , E = 200 V. Calculate the power dissipated in the 1500-ohm resistor.

A. 0.76 W B. 0.83 W C. 0.71 W D. 0.86 W

Problem 779:

A half-wave rectifier draws power from a power transformer at 24 volts and delivers 200 mA to a load. Determine power drawn by load.

A. 0.48 W B. 1.25 W C. 2.16 W D2.05 W

Problem 780:

An AC ammeter is connected in series across the output of a full wave rectifier. This meter reads 8 A. If a moving coil ammeter is replaced instead of the AC ammeter, what will be its expected reading?

A. 8.0 A B. 7.6 A C. 7.2 A D. 5.6 A

Problem 781:EE Board October 1987

In the electronic laboratory, a diode rectifier tube has a plate resistance of 600 ohms (assumed constant) and is connected as a half-wave rectifier to a load resistance of 1,400 ohms. The energizing supply voltage is 440 volts effective, 60 Hz alternating current. Find the average load voltage.

A. 138.5 V B. 132.8 V C. 133.6 V D. 150.2 V

Problem 782:

Three identical transformers are used to supply power to an iodizing plant requiring 1000 A at 28 V DC through a 3-phase half wave rectifier. The transformers are connected delta-wye. What are the secondary current and voltage of each transformer?

A. 1042 A, 28.47 V B. 1017 A, 16.44 V C. 1042 A, 16.44 V D. 1017 A, 28.47 V

Problem 783:EE Board October 1987

In the electrical laboratory, a diode rectifier tube has a plate resistance of 600 ohms (assumed constant) and is connected as a half-wave rectifier to a load resistance of 1,400 ohms. The energizing supply voltage is 440 volts effective, 60 Hz alternating current. Find the rms rectified current.

A. 0.162 A B. 0.155 A C. 0.208 A D. 0.311 A

Problem 784:EE Board April 1997

A resistor is connected across an AC supply of 220 volts. The power drawn is 1,000 watts. If a diode were connected in series with the resistor, what would be the power absorbed by the resistor?

A. 850 W B. 250 W C. 750 W D. 500 W

Problem 785:EE Board October 1996

A circuit consists of a resistor that is connected in series with a perfect diode. When connected across a 20-V battery the current measured is 10 A. However, when connected across a 30-V battery but with reversed polarity, what would be the new current?

A. 15 A B. Zero current C. 20 A D. None of the answered listed

Problem 786:EE Board April 1997

A germanium diode, which has an offset voltage of 0.2 V and an incremental resistance of 20 ohms, is connected in series with a 10,000-ohm resistor across a 100 V DC source. What is the current?

A. 9.98 mA B. 10 mA C. 9.78 mA D. 9.96 mA

TEST 22- TRANSMISSION LINES

Problem 787:

A single solid round copper wire has a diameter of 0.50 inch. Determine its self GMD.

A. 0.3894 inch B. 0.1947 inch C. 0.1825 inch D. 0.25 inch

Problem 788:

Determine the mutual GMD of a three-phase single-circuit transmission line whose conductors arranged in a triangular formation so that the two distances between conductors are 20 ft and the third is 38 ft, respectively?

A. 24.77 ft B. 25.35 ft C. 23.67 ft D. 26.43 ft

Problem 789:

A three-phase double circuit line has a horizontal spacing of 40 ft and a vertical spacing between adjacent levels of 25 ft. Determine the mutual GMD of the line.

A. 43.08 ft B. 42.64 ft C. 41.42 ft D. 40.56 ft

Problem 790:EE Board March 1998

A 230 kV transmission line is 100 miles long. The conductor is ACSR of 1,113,000 CM. The conductors are horizontally arranged with 20 ft spacing. The resistance per mile is 0.0969 ohm and its GMR is 0.0435 ft. What is the impedance of the line?

A. 9.69 + j 95.25 ohms B. 3.23 + j 95.25 ohms
C. 9.69 + j 77.19 ohms D. 3.23 + j 25.93 ohms

Problem 791:EE Board October 1997

A 34.5 kV feeder line is 5 miles long. The conductors are space 4 feet horizontally. The conductor is 4/0 copper with GMR of 0.01668 ft. What is the reactance?

A. 2.36 ohms B. 6.72 ohms C. 3.46 ohms D. 5.16 ohms

Problem 792:

A single-phase transmission line 15 km long is using copper conductors of diameter 0.8 cm. If the distance between conductors is 1.25 m, determine the self-inductance of the transmission lines.

A. 0.036 H B. 0.024 H C. 0.072 H D. 0.055 H

Problem 793:EE Board October 1998

A 5 km long, three-phase line has a horizontal configuration of 4 ft spacing. The conductor is 336.4 MCM ACSR with GMR of 0.0244 ft and a resistance of 0.306 ohm per mile. What is the impedance?

A. 2.22 cis 65 B. 1.19 cis 46 C. 6.66 cis 65 D. 3.57 cis 46

Problem 794:

A 170- mile, 230- kV, 60- Hz, three- phase single- circuit transmission line uses a triangular arrangement with 20 ft, 220 ft and 36 ft spacing respectively. If the line conductors have a GMR of 0.0217 ft, determine the capacitive susceptance to neutral per mile.

A. 4.18×10^{-6} mho per mi B. 12.74×10^{-6} mho per mi

C. 7.92×10^{-6} mho per mi D. 2.47×10^{-6} mho per mi

Problem 795:

A single- circuit, 3- phase, 60 Hz transmission is using a horizontal arrangement with a spacing distance of 4 m between adjacent conductors. If each conductor has an outside diameter of 0.8 cm, determine the capacitance to neutral per meter.

A. 8.352 pF/m B. 7.793 pF/m
C. 6.742 pF/m D. None of these

Problem 796:

A single- phase transmission line has total impedance of 1.5 + j0.3 ohms. It delivers 3 MW at 11 kV and at unity power factor. Determine the sending end voltage of the transmission lines.

A. 11.41 kV B. 11.24 kV C. 12.02 kV D. 11.89 kV

Problem 797:

A single- phase transmission line has total impedance of $5\angle 60^{o}$ ohms and supplies a total load of 120 A, 3.3 kV and at 0.8 power factor lagging. Calculate the sending end voltage.

A. 3.93 kV B. 3.62 kV C. 3.54 kV D. 3.86 kV

Problem 798: EE Board April 1981

A three- phase, 3- wire short transmission line has a resistance of 3 ohms and a reactance of 8 ohms per wire. At the receiving end, a balanced 3- phase load draws a line current of 60 A, at 13,500 volts line-to-line, 0.90 power factor lagging. Determine the voltage at the sending end.

A. 14,156 V B. 14,143 V C. 14,230 V D. 15,055 V

Problem 799: EE Board October 1996, EE Board April 1997

A load of 12 MVA, 0.8 pf lagging, 22 kV is served by a transmission line, which has a line resistance of 3 ohms and a line reactance of 10 ohms. Solve for the sending end voltage.

A. 24,345 V B. 26,795 V C. 23,335 V D. 25,422 V

Problem 800: EE Board April 1982

A short 3- phase, 3-wire line has a resistance of 5 ohms and reactance of 12 ohms per wire and transmit power to a three- phase load drawing 1000 kW at 13,120 volts line- to- line, 0.8 pf lagging, 60 Hz. Solve for the sending end voltage.

A. 14,200 V B. 14,330 V C. 14,130 V D. 14,240 V

Problem 801: EE Board April 1991

A 3- phase line has a reactance of 4.32 ohms and a resistance of 4.15 ohms. The load at receiving end is 3800 kW at 75% power factor lagging and the voltage at the sending end is 36 kV. Determine the voltage at the receiving end.

A. 34.24 kV B. 34.86 kV C. 35.14 kV D. 35.45 kV

Problem 802: EE Board March 1998

A short 230- kV transmission line has impedance of 5 cis 78 ohms. The sending end power is 100 MW at 230 kV and 85% power factor. What is the voltage at the other end?

A. 225.4 kV B. 226.3 kV C. 223.2 kV D. 228.2 kV

Problem 803: EE Board October 1996

A three- phase transmission line, 15 km long serves a substation rated 15 MVA at 34.5 kV, 60 Hz. If the line resistance is 0.12 ohm per kilometer and the line reactance is 0.457 ohm per kilometer, what should be the sending end voltage be so that the transformer can be fully loaded at its rated voltage and unity pf.

A. 37,200 V B. 36,500 V C. 35,408 V D. 34, 990 V

Problem 804:

A three- phase transmission line, 10 km long delivers a load of 5000 kW at 11 kV and 0.8 pf lagging at the receiving end. The resistance of the line per km per phase is 0.1 ohm and the reactance per phase per km is 0.2 ohm. Solve for the regulation of the line.

A. 12.44% B. 11.05% C. 10.45% D. 10.12%

Problem 805: EE Board April 1980

A 3- phase, 3-wire short transmission line having an impedance of 3.6 + j16 ohms per wire is used to supply an inductive load of 100 A at 0.707 pf and a capacitive load of 50 A at 0.50 pf. The receiving end voltage is 4160 volts per phase. Find percent regulation.

A. 25.46% B. 20.33% C. 26.34% D. 23.71%

Problem 806:

It is desired to deliver 4000 kW, three- phase at distance of 25 miles. The load being 33 kV, 60 Hz and the power factor of the load being 85% lagging. The reactance of the line per phase is 0.692 ohm per mile. The line loss is 10% of the power delivered. Determine voltage regulation of the line.

A. 11.2% B. 12.3% C. 113.2% D. 14.8%

Problem 807: EE Board October 1998

A short 230 kV transmission line has an impedance of 5 cis 78 ohms. The sending end power is 100 MW at 230 kV and 85% power factor. What is the percent regulation of the line?

A. 3.6% B. 1.5% C. 2.2% D. 0.77%

Problem 808: EE Board October 1983

A short subtransmission line serves at its end an induction motor rated 500 HP, 0.88 pf, 0.90 efficiency, at 2,400 volts phase to neutral. If the transmission has a resistance of 1.5 ohms and a reactance of 2.4 ohms per phase, solve for the voltage regulation of the line.

A. 6.77% B. 7.02% C. 6.48% D. 6.25%

Problem 809:

A short 3- phase, 3- wire transmission line has an impedance of 2 + j6 ohms per wire, at the receiving end are connected a three- phase inductive load drawing 5000 kW at 0.8 pf, line-to-line voltage of 13,800 V and a capacitor bank drawing 200 A line current. Solve for the power at the sending end.

A. 5,562 kW B. 5,146 kW C. 5,361 kW D. 5,274 kW

Problem 810:

A short 3- wire transmission line has an impedance of 2 + j5 ohms per wire. At the receiving end, a balanced 3- phase load and capacitor bank draw 3000 kVA, 0.71 pf lagging and 600 kVAR respectively at 8000 volts per phase to neutral. Determine the power loss of the transmission line.

A. 81.32 kW B. 69.57 kW C. 90.74 kW D. 71.09 kW

Problem 811:

A 10- km, three- phase transmission line delivers power to a load rated 200 kW, 6.9 kV and at 80% lagging power factor. The resistance and reactance of each line are 0.8 and 1.2 ohms, respectively. What percentage of the power generated is lost in the transmission line?

A. 9.53% B. 8.05% C. 8.22% D. 7.46%

Problem 812: EE Board October 1993

Each conductor of a three- phase, 3- wire transmission line has impedance of 15 + j20 ohms at 60 Hz. The voltage between line conductors at the sending end is 13,200 volts. The load connected to this line is balanced and takes 1000 kW at a lagging power factor. The current per conductor is 70 A. What is the load power factor?

A. 0.803 lagging B. 0.824 lagging C. 0.850 lagging D. 0.815 lagging

Problem 813:

A 15 MW, 132 kV, 80% pf three- phase load is to be serve by a transmission line having conductors whose resistance is 0.5 ohm/km. If the losses on the line shall not exceed .5%, how long must this line be?

A. 68 km B. 70 km C. 66 km D. 75 km

Problem 814:

A three- phase, three- wire transmission line supplies at the receiving end an inductive load of 5000 kW at 0.8 pf and the line-to-line voltage 13,250 V and in addition a capacitor bank that draws a line current of 90 A. The effective impedance of the transmission line is 2 +j3 ohms per wire. Determine the sending power.

A. 5317 kW B. 5530 kW C. 52555 kW D. 5410 kW

Problem 815: EE Board April 1982

A short three- phase, three- wire line has a resistance of 5 ohms and reactance of 12 ohms per wire and transmit a power to a 3- phase load drawing 1000 kW at 13,120 volts line to line, 0.8 pf lagging, 60 Hz. Solve for the sending end power factor.

A. 0.755 lagging B. 0.745 lagging B. 0.754 lagging D. 0.773 lagging

Problem 816: EE Board October 1982, EE Board October 1987

A short three- phase transmission line has a resistance of 3 ohms and an inductive reactance of 4 ohms. At the receiving end the voltage is13, 250 volts line-to-line, with a load which draws 200 A at 0.707 lagging power factor and capacitor bank drawing 96 A. solve for the power factor at the sending end.

A. 0.965 lagging B. 0.902 lagging C. 0.928 lagging D. 0.935 lagging

Problem 817: EE Board April 1985

The sending end voltage of a balanced 3- phase transmission line is 8410 volts, phase to neutral. The line current is 200 amperes with a sending end lagging power factor of 0.803. The receiving end voltage is 7600 volts, phase to neutral, with a line current having a lagging power factor of 0.85. Solve for the impedance of the transmission line.

A. 1.47 + j 5.15 Ω B. 1.42 + j 5.15 Ω C. 1.47 + j 5.04 Ω D. 1.42 + j 5.04 Ω

Problem 818:EE Board April 1986

A short, 3-phase, 3-wire transmission line has a receiving end voltage of 4160 V phase to neutral and serving a balanced 3-phase load of 998,400 volt-amperes at 0.82 pf lagging. At the sending end the voltage is 4600 V, phase to neutral and the pf is 0.77 lagging. Solve the resistance of the line.

A. 1.345 Ω B. 1.462 Ω C. 1.475 Ω D. 1.635 Ω

Problem 819:EE Board April 1984, EE Board April 1987

At the sending end of a 3-phase transmission line, the voltage is measured to be 2,540 volts phase to neutral and the line current to be 60 A at a lagging power factor of 0.75. At the receiving end, the voltage measured is 2,200 volts phase to neutral and the power factor is 0.80, likewise lagging current. Solve for the resistance and reactance of the line.

A. 2.2 + j 4 B. 2.4 + j 6 C. 2.0 + j 5 D. 2.1 + j 3

Problem 820:

A three-phase transmission line 5 km long delivers 2 MVA at a power factor of 0.80 lagging. The resistance and reactance per km of each conductor are 0.3 ohm and 0.6 ohm, respectively. Calculate the voltage at the sending end. Assume a transmission line loss of 7.2% of the power factor delivered to the load.

A. 4405.45 V B. 4166.67 V C. 4810.50 V D. 4652.85 V

Problem 821:EE Board April 1993

A certain station in Luzon has 36 kV, 3-phase, is to supply12 MW load at 30 kV and 0.8 power factor lagging over a 3-phase transmission line. Find the resistance of the line if the length of the transmission line is 4,000 meters and the efficiency is 90%.

A. 5.33 ohms B. 4.45 ohms C. 6.31 ohms D. 3.56 ohms

Problem 822:

A three-phase, 3-wire transmission line has an impedance per wire of 3 + j7 ohms, the receiving end load is 1950 kW, 0.65 pf lagging with the line voltage of 13,200 V. Determine the efficiency of the line.

A. 92.64% B. 95.21% C. 90.24% D. 93.05%

Problem 823:EE Board October 1980

A short line has a resistance of 4 ohms and a reactance of 12 ohms per wire and transmits power to a concentrated load of 1000 kVA, 13,200 volts, 3-phase, 60 Hz, 0.8 pf inductive load. Find its efficiency.

A. 93.30% B. 96.95% C. 95.75% D. 97.21%

Problem 824:EE Board October 1998

A 230 kV transmission line is sending 100 MW power at 230 kV and 90% power factor. The impedance is 5 + j 20 and its capacitive reactance is 2500 ohms. Determine the receiving end voltage.

A. 221.72 kV B. 222.83 kV C. 226.15 kV D. 224.28 kV

Problem 825:EE Board October 1996

A 3-phase, 60 Hz transmission line delivers 20 MVA to a load at 66 kV at 80% pf lagging. The total series impedance of each line is 15 + j 75 ohms. If a nominal "pi" circuit is used, what would be the transmission efficiency if the admittance is j0.0006 mhos?

A. 90.8% B. 91.7% C. 93.5% D. 92.6%

Problem 826:EE Board March 1998

A 230 kV transmission line has an impedance of 50 cis 78 ohms and a capacitive reactance of 1200 ohms. It transmits the power of a base load plant. On a certain dry season the sending end power is 100 MW at 235 kV and 95% power factor continuously for a period of one month. If cost of generation is 1.30 pesos per kW-hr, what is the cost of the line losses for the one month period?

A. P 565,000 B. P 12.2 million C. P 5.6 million D. P 2.3 million

TEST 23- POWER FACTOR CORRECTIONS

Problem 827:EE Board October 1996

A 132kV line three-phase system delivers 70.7 MVA of a balanced delta load of power factor 70.7% lagging. Determine the reactance necessary to attain unity power factor.

A. Xc = 1,092 Ω B. Xc = 965 Ω C. Xc = 1,142 Ω D. Xc = 1,045 Ω

Problem 828:EE Board October 1990

A single-phase inductive load takes 50 kVA at 0.60 power factor lagging. Solve for the kVAR of a capacitor required to improve the power factor to 1.0.

A. 30 kVAR B. 20 kVAR C. 22.5 kVAR D. 40 kVAR

Problem 829:

A single-phase load on 220 V takes 5 kW at 0.6 lagging power factor. Find the kVAR size of capacitor, which maybe connected in parallel with this motor to bring the resultant power factor to 1.0.

A. 6.67 B. 7.32 C. 8.66 D. 6.26

Problem 830:

A 5 hp, 220 V, 60 Hz, single-phase induction motor operates at an efficiency and power factor of 0.88 and 0.8 respectively. What capacitance should be connected across the motor in order for the feeder supplying this motor to operate at unity power factor?

A. 201.55 μF B. 183.52 μF C. 174.22 μF D. 212.56 μF

Problem 831:EE Board October 1987

Installed in one of the customer of CEPALCO are two single phase transformers each rated 75 kVA are connected V or open delta to serve a 3-phase load of 120 kW at 0.8 pf lagging. To prevent the overloading of the transformers, determine the size of the capacitor in kVAR.

A. 40 B. 41 C. 39 D. 42

Problem 832:

Three transformers each rated 100 kVA are connected delta supplying a load of 160 kW at 0.8 pf lagging. One of the transformers is taken for repair and the rest are connected open delta. What kVAR (minimum) of capacitor must be connected with the load so that the load of the remaining transformers will be 95% of their combined rated capacities.

A. 85.32 B. 81.62 C. 87.58 D. 80.92

Problem 833:EE Board October 1993

Three single- phase transformers each rated 75 kVA are banked in delta and supplying a 3- phase load drawing 160 kVA at 0.8 lagging power factor. If one transformer is removed for repairs, solve for the minimum amount in kVAR of capacitor needed to prevent overloading of the remaining units.

A. 70.32 B. 73.64 C. 72.46 D. 73.28

Problem 834

Two single- phase transformer each rated 150 kVA are connected open delta supplying a three- phase induction motor rated 250 hp, 0.7 pf and 80% efficiency. Determine the minimum size in kVAR of a capacitor needed to prevent overloading the transformers.

A. 135 B. 126 C. 120 D. 123

Problem 835: EE Board October 1982

Two single- phase transformers are each rated 75 kVA are connected in V or open delta to serve a 3- phase load of 120 kW at 0.80 power factor lagging. Determine the size in kVAR of the capacitor needed to prevent overloading of the transformers.

A. 40.25 B. 41.28 C. 45.24 D. 43.50

Problem 836: EE Board April 1984

A plant has a load of 290 kilowatt with an average power factor of 70%. The owner requests you to correct the power factor to reduce its power consumption. How much capacitor kVAR is required to increase the power factor to 90%?

A. 152.46 B. 155.39 C. 150.34 D. 154.58

Problem 837: EE Board October 1982

A 150-kVA-transformer bank will serve a load expected to draw 135 kW at 0.80 lagging power factor. Solve for the size of the capacitor bank needed to be added in order to prevent overloading of the transformer bank.

A. 32.506 kVAR B. 35.866 kVAR C. 40.391 kVAR D. 28.266 kVAR

Problem 838: EE Board October 1981

A 3- phase generator has the following 3- phase loads: an inductive load drawing 400 kVA at 0.60 power factor and a resistive load drawing 80 kVA at 1.00 power factor. Solve for the size in kVAR of the capacitor bank needed to improve the power factor of the combined loads to 0.85 lagging.

A. 120.58 kVAR B. 121.68 kVAR C. 124.54 kVAR D. 122.82 kVAR

Problem 839: EE Board April 1997

A load of 10,000 kVA, 80% pf lagging is connected to a 13,200 volts line. How much capacitive reactive power is needed to correct the power factor to 0.97 lagging?

A. 5,156 kVAR B. 3,138 kVAR C. 2,547 kVAR D. 4,395 kVAR

Problem 840: EE Board April 1986

A short, 3- phase, 3- wire transmission line has a receiving end voltage of 4160 V phase to neutral an serving a balanced 3- phase load of 998,400 volt amperes at 0.82 pf lagging. At the receiving end the voltage is 4600 V phase to neutral and the pf is 0.77 lagging. Solve for the size in kVAR of the capacitor needed to improve the receiving end pf to 0.9 lagging maintaining 4160 V.

A. 181 B. 175 C. 172 D. 178

Problem 841:

A short, 3- phase, 3- wire transmission line has an impedance per wire of 3 + j7 ohms, the receiving end load is 1950 kW, 0.65 pf lagging with the line voltage of 13,200 V. determine the kVAR of the capacitor to be connected at the receiving end to make the pf at that end to 0.8 lagging.

A. 824.56 B. 871.45C. 803.88 D. 817.32

Problem 842: EE Board October 1980

A balanced, 500 kVA, 3- phase, 440 volt, 60 Hz inductive load operates at a pf of 75%. Determine the total capacitor kVAR required improving the pf to 95%.

A. 207.46 B. 176.42 C. 210.75 D. 192.21

Problem 843: EE Board March 1998

A single- phase induction motor is rated 5 hp, 75% power factor and 220 volts. What approximate size of the capacitor size is necessary to raise the power factor to about 95%?

A. 3 kVARB. 2 kVARC. 2.5 kVAR D. 3.5 kVAR

Problem 844: EE Board October 1984

A balanced 3-phase load draws 150 A phase current at 7.5 kV phase to neutral, 0.891 power factor lagging. It is desired to raise the power factor to 0.96 leading. Solve for the amount of capacitor kVAR needed to achieve such pf.

A. 2273 kVAR B. 2409 kVAR C. 2509 kVAR D. 2365 kAVR

Problem 845:EE Board April 1981

A 3-phase, 3-wire, short transmission line has a resistance of 3 ohms and a reactance of 8 ohms per wire. At the receiving end, a balanced 3-phase load draws a line current of 60 A, at 13,500 V, solve the size in kVAR of capacitors needed to raise the power factor at the receiving end to 0.95 leading.

A. 1043.5 B. 1154.2 C. 1026.5 D. 1232.2

Problem 846:

The input to an induction motor from a 13 kV, 60 Hz line is 1000 kVA, at 0.8 pf lagging. A capacitor is placed in parallel with the motor to improve the pf. Calculate the capacitance required raising the power factor to 0.9 leading.

A. 62 μF B. 50 μF C. 43 μF D. 56 μF

Problem 847:EE Board April 1981

A three-phase balanced load draws a line current of 80 A at 0.90 lagging power factor. Solve the minimum size in kVAR of the capacitor bank needed to raise the power factor to 0.95 leading, if the line to line voltage is 13,200 volts.

A. 1310.15 B. 1338.25 C. 1247.54 D. 1430.12

Problem 848:EE Board October 1990

Two Y-connected, 50° rise induction motors are fed by a 4160 V, line to line, 3-phase 60 Hz motor-control center 20 feet away. Motor #1 drives a 600-hp compressor. The efficiency of this motor is 90% and its power factor is 0.5. Instruments of motor #2 indicate 1730 kW, 277 amperes. Determine the capacity in microfarads per phase of a wye-connected bank that is required to correct the power factor of the total load to 0.966 lagging.

A. 172.4 μF B. 193.8 μF C. 167.2 μF D. 182.1 μF

Problem 849:

A 2.3 kV three-phase system supplies a 120-kW, 0.6 pf lagging balanced load. Determine the capacitance in each phase of a wye-connected capacitor bank to adjust the power to 0.90 lagging.

A. 51.1 μF B. 52.2 μF C. 62.5 μF D. 78.2 μF

Problem 850:EE Board October 1996

A single-phase, 60 Hz, 5 hp squirrel cage induction motor draws a current of 53 A at 117 V. If it has a 78.5% electrical to mechanical conversion efficiency, what capacitance should be connected at the terminals of the motor in order to increase the power factor of the load combination to 92%?

A. 480 μF B. 380 μF C. 320 μF D. 420 μF

Problem 851:EE Board April 1989

A three-phase, 60 Hz, 2200 volts induction motor develops 500 HP, 0.8 lagging pf and efficiency of 94%. The power factor is raised to 0.90 lagging by connecting a bank of condensers in delta across the lines. If each of the capacitance unit is built up of four similar 550 V condensers, calculate the capacitance of each condenser.

A. 77.04 μF B. 75.42 μF C. 76.12 μF D. 72.30 μF

Problem 852:EE Board April 1993

A star-connected 400 Hp (metric), 2000 V, 50 c/s motor works at a power factor of 0.7 lagging. A bank of mesh-connected condensers are used to raise the power factor to 0.93 lagging. Calculate the capacitance of each unit required if each is rated 500 V, 50 c/s. The motor efficiency is 85%.

A. 194 μF B. 225 μF C. 302 μF D. 233 μF

Problem 853:

A factory draws a lagging load of 2000 kW at a power factor of 60% from a 6 kV bus line. A synchronous capacitor is installed to raise the overall power factor to unity. Assuming the synchronous capacitor losses are 275 kW, calculate the operating power factor of the synchronous capacitor.

A. 0.201 leading B. 0.103 leading C. 0.302 leading D. 0.113 leading

Problem 854:

A 400-V three-phase balanced load takes 40 A at a lagging power of 0.8. An over- excited synchronous motor is connected to raise the power factor to unity. If the mechanical output of the motor is 15 hp and its efficiency is 85%, find the kVA input to the motor.

A. 24.2 kVA B. 18.7 kVA C. 20.3 kVA D. 21.2 kVA

Problem 855:

A three-phase load of 100 kVA operates at 0.707-pf lagging. Solve for the operating power factor of a synchronous condenser necessary to raise the system power factor to 0.866 lagging, and so arrange that the system apparent power is the same as before the correction.

A. 0.632 leading B. 0.882 leading C. 0.705 leading D. 0.609 leading

Problem 856:

An industrial plant has an electrical load of 5000 kW at 80% pf lagging. It has been decided to replace a 500-hp induction that drives a pump. This motor operates at an efficiency of 90% and a pf of 0.9 lagging. If a synchronous motor is purchased as a replacement, which is capable of operating at 0.80 pf leading. What will be the new plant pf. Assume the synchronous motor to have the same efficiency.

A. 0.863 B. 0.823 C. 0.837 D. 0.852

Problem 857:

A synchronous motor is drawing 60 kW is connected in parallel with a load drawing 250 kW at a lagging power of 0.8. If the combined load has a power factor of 0.9, at what power factor is the synchronous motor operating?

A. 0.862 leading B. 0.849 leading C. 0.868 leading D. 0.874 leading

Problem 858:EE Board October 1985

An inductive load consumes 10 kW at 0.75 pf lagging. A synchronous motor with a pf of 0.9 leading is connected in parallel with the inductive load. What is the minimum required kW size of the synchronous motor so that the combined load will have a pf of 0.8 lagging.

A. 1.068 kW B. 1.203 kW C. 1.075 kW D. 1.109 kW

Problem 859:EE Board April 1980, EE Board April 1992

An industrial plant draws 500 kW at 0.6 power factor from a three-phase system. In order to raise the power factor to 0.866 lagging and to supply needed additional power, a synchronous motor is added . This motor draws 300 kW, bringing the new total plant load to 800 kW. Neglecting the losses of the synchronous motor, calculate the exact required kVA rating.

A. 363.24 Kva B. 345.34 kVA C. 393.34 kVA D. 307.35 kVA

Problem 860:

An induction motor load of 1500 kW consists of several units in parallel, operating at an average power factor of 0.80 lagging. In order to improve the power factor, a portion of the induction motor loads is to be replaced by a synchronous motor, operating at the same efficiency as the induction motors and at a power factor of 0.70 leading. Find the kVA rating of the synchronous motor required bringing the power factor of the total load to 0.90 lagging. Assume the induction motor load, which has to be replaced, operates at the same pf as the induction motor group.

A. 332 kVA B. 325 kVA C. 300 kVA D. 322 kVA

Problem 861:

An alternator rated 530-kVA, is operating at 0.60 pf lagging. A synchronous condenser is in parallel to improve the pf to 90% lagging. Determine the operating power factor of the synchronous condenser. Assume the alternator is not supposed to be overloaded.

A. 0.546 leading B. 0.447 leading C. 0.643 leading D. 0.593 leading

Problem 862:

An over-excited synchronous motor is connected across a 150 kVA, 0.70 lagging power factor load. The motor takes 12 kW while running on no-load. Calculate the kVA rating of the motor required in order to bring the overall pf of the motor-inductive load combination to unity.

A. 106.22 B. 107.78 C. 110.20 D. 105.58

Problem 863:

An industrial load takes 250 kW at 60% pf from a 600 V, 60 Hz, 3-phase feeder. It is desired to raise the pf of the entire feeder to 90% by means of a synchronous motor, which at the same time is to drive a dc compound generator, requiring that the synchronous motor takes 70 kW from the line. Determine the required current rating of the synchronous motor.

A. 175.53 A B. 184.37 A C. 192.65 A D. 188.44 A

Problem 864:EE Board April 1998

An existing industrial plant has an average load of 900 kW at 0.6 pf lagging. To raise the overall power factor to 0.92, a synchronous motor driving a DC generator is to be installed. If the input of the synchronous motor will be 250 kW, calculate its kVA input rating.

A. 753 kVA B. 788 kVA C. 723 kVA D. 715 kVA

TEST 24 – FAULTS ON ELECTRICAL SYSTEM

Problem 865:

In symmetrical components, what is the vector sum of $1 + a + a^2$?

A. 1 B. 0 C. –1 D. Infinity

Problem 866:EE Board October 1998

If the load of a wye-connected transformer are:

I_a= 10 cis (-30) I_b= 12 cis 215 I_c= 15 cis 82

What is the phase b positive sequence component?

A. 13.4 cis (-32.2) B. 10.2 cis 240 C. 12.27 cis 208.4 D. 12.27 cis (-31.6)

Problem 867:

Given three unbalanced three-phase voltages:

V_a = 150 + j0 V V_b = -90 – j120 V V_c = -120 + j90 V

Determine $V_{a1.}$

A. 142.43 + j12.35 B. 135.32 – j21.34

C. 145.62 + j13.66 D. 140.23 – j9.32

Problem 868: EE Board March 1998

The three- phase unbalanced currents are:

I_a = 10 cis (-30) I_b = 0 I_c = 10 cis 150

Find the negative sequence current of phase a.

A. 8.66 cis 30 B. 5.77 cis (-60) C. -5.77 D. 5.77

Problem 869: EE Board October 1984

Given the following currents:

I_a = 60 + j0 A I_b = -36- j48 A I_c = -48 + j36 A

Solve for the negative sequence component of I_a.

A. 8.641 – j1.543 B. 9.436 + j1.346 C. 9.751 – j1.464 D. 8.354 + j1.034

Problem 870: EE Board October 1998

The three- phase unbalance currents are:

I_a = 10 cis (-30) I_b = 0 I_c = 10 cis 150

Find the zero sequence current.

A. 3.33 cis 30 B. 0 C. 5.77 D. 3.33

Problem 871: EE Board October 1984

Given the following currents:

I_a = 60 + j0 A I_b = -36 – j48 A I_c = -48 + j36 A

Solve for the zero sequence component of I_a.

A. 10 + j4 B. 8 – j6 C. -8 – j4 D. 12 – j6

Problem 872: EE Board October 1997

The sequence current of phase a current are as follows:

Zero sequence current = $14.13\angle 17.34^o$

Positive sequence current = $2.98\angle 10.06^o$

Negative sequence current = $708.26\angle -31^o$

Determine phase a current.

A. $720\angle -30^o$ B. $730\angle -15.2^o$ C. $710\angle 88^o$ D. $695\angle 15.2^o$

Problem 873: EE Board October 1998

A sequence component of phase a current are:

Zero sequence component = 0.47 + j1.49

Positive sequence component = 18.4 cis (-31.6)

Negative sequence component = 3.23 cis 168.2

Determine the phase b current.

A. 18 cis 215 B. 15 cis 240 C. 19 cis 220 D. 20 cis 225

Problem 874:EE Board March 1998

The sequence components of phase a current are:

Zero sequence = 0.47 + j1.49

Positive sequence = 18.4 cis (-31.6)

Negative sequence = 3.23 cis 168.2

Determine phase c current.

A. 17.5 cis 91 B. 18 cis 215 C. 22.5 cis 82 D. 15 cis 100

Problem 875: EE Board April 1992

Determine the symmetrical components of the line current in line 'a' if one of the in phases impedance of its delta- connected load connected across lines 'ca' is removed. The delta load with impedance of $10\angle 0^{o}$ ohms per phase is supplied from a 220 volts, 60 cycle, 3- phase. Assume a phase sequence of a-b-c.

A. $l_{a1} = 11$ A, $l_{a2} = 11$ A, $l_{a0} = 0$ A

B. $l_{a1} = 7.33$ A, $1_{a2} = 7.33$ A, $l_{a0} = 7.33$ A

C. $l_{a1} = 22$ A, $l_{a2} = 22$ A, $l_{a0} = 22$ A

D. $l_{a1} = 25.4$ A, $l_{a2} = 12.7$ A, $l_{a0} = 0$ A

Problem 876: EE Board April 1991

A star- connected balanced load takes 75 A from a balanced 3- phase, 4- wire supply. If the two supply lines of the fuses are removed determine the symmetrical components of the line currents after the fuses are removed.

A. $l_1 = 25$ A, $l_2 = 25$ A, $l_0 = 25$ A

B. $l_1 = 25$ A, $l_2 = 50$ A, $l_0 = 0$ A

C. $l_1 = 75$ A, $l_2 = 75$ A, $l_0 = 75$ A

D. $l_1 = 75$ A, $l_2 = 0$ A, $l_0 = 0$ A

Problem 877: EE Board March 1998

A 50 MVA, 33 kV/11 kV, three- phase, wye- delta connected transformer has a 3% impedance. What is the percent impedance at 100 MVA base and 34.5 kV base?

A. 1.639% B. 5.49% C. 5.74% D. 6.56%

Problem 878:

At a certain location of an electrical system, the available short circuit MVA is10 at 110 kV while its Thevenin's equivalent reactance is 0.05 pu. Determine the per unit reactance unit of this point using a base 20 MVA and 115 kV.

A. 0.08 B. 0.07 C. 0.06 D. 0.09

Problem 879:

A 13.8 kV/440 V, 50 kVA single- phase transformer has a leakage reactance of 300 ohms referred to the 13.8 kV side. Determine the per unit value of the leakage reactance for the voltage base.

A. 0.074 B. 0.082 C. 0.083 D. 0.079

Problem 880: EE Board April 1980

A 5 kVA, 2400-120/240 volt distribution transformer when given a short circuit test had 94.2 volts applied with rated current flowing in the short- circuited wiring. What is the per unit impedance of the transformer?

A. 0.0392 ohms B. 0.0386 ohms C. 0.0415 ohms D. 0.0435 ohms

Problem 881:

A 3- phase, 375 kVA, 480 V, 50 Hz, wye- connected alternator has an equal positive and negative sequence reactance of 10%. Find the symmetrical fault current, if a 3- phase fault occurs at the alternator terminals.

A. 4510.5 A B. 4620.3 A C. 4255.2 A D. 4778.1 A

Problem 882: EE Board April 1992

A generator rated 600 kVA, 2400 V, 60 cycles, 3- phase, 6- poles and wye- connected has 10% synchronous reactance. If a 3- phase fault occurs, what will be the short circuit current?

A. 1443 A B. 1532 A C. 1435 A D. 1428 A

Problem 883:

A 20 MVA, 13.8 kV, 660 Hz, three- phase synchronous turbo alternator has a positive and negative zero sequence reactances of 0.25, 0.35, 0.15 respectively. If lines b and c are short- circuited, determine the subtransient fault current in line b. Assume the alternator is operating at no load and at rated voltage with the neutral of the alternator solidly grounded.

A. 2614 A B. 2886 A C. 2415 A D. 2510 A

Problem 884: EE Board March 1998

At a certain location in an electric system, the available fault MVA is 400 MVA. A 15 MVA, 34.5 kV/6.24 kV, 2.5% impedance, wye- wye grounded transformer is installed at that location. Determine the short circuit MVA at the secondary side of the transformer.

A. 195 MVA B. 150 MVA C. 90 MVA D. 240 MVA

Problem 885:

Two three- phase transformers are connected in parallel at the primary as well as at the secondary sides. One is rated 10 MVA, 34.5/13.8 kV and 4% impedance while the other is rated 7.5 MVA, 34.5/13.8 kV and 5% impedance. The primary tapping point has a 3- phase short circuit MVA of 1000 MVA. Determine the fault current delivered to a 3- phase fault at the secondary side bus bars.

A. 13,501 A B. 10,452 A C. 12,532 A D. 11,953 A

Problem 886:

A 100 MVA, 22 kV synchronous turbo generator has positive and negative reactances of 0.20 p.u. and a zero sequence reactance of 0.05 p.u. The neutral of the generator is grounded through a reactor of 0.242 ohm. Determine the ratio of the subtransient current for a single line to ground fault to the subtransient current for a three-phase fault. Assume the generator is operated without a load and at rated voltage.

A. 1.50 B. 1.25 C. 1.00 D. 0.80

Problem 887: EE Board October 1992

A generator is rated 100 MVA, 15 kV, it is Y- connected, solid grounded and is operated at rated voltage at no- load and is disconnected from the rest of the system. Its positive and negative sequence reactances are each 0.10 p.u. and its zero sequence reactance is 0.05 p.u. Calculate in ohms of inductive reactance to be inserted in the neutral connection of the generator to limit the fault current for a single line to ground fault to the fault current of a symmetrical three- phase fault.

A. 0.0233 Ω B. 0.0225 Ω C. 0.0376 Ω D. 0.0325 Ω

Problem 888: EE Board October 1982

The reactance of a three- phase alternator is 8 percent. If the alternator is rated 25 MVA at 13.25 kV output voltage, line to phase, solve for the magnitude of the fault current generated when a short circuit occurs between 2 phases at the terminals.

A. 6704 A B. 6135 A C. 6808 A D. 6458 A

Problem 889:

A 3- phase, 375 kVA, 480 V, 50 Hz, wye- connected alternator has an equal positive and negative sequence reactance of 10%. Find the unsymmetrical fault current, if a 2- phase fault (line-to-line) occurs at the alternator terminals.

A. 3890 A B. 3906 A C. 4510 A B. 4180 A

Problem 890: EE Board March 1998

A 5 MVA, 13.8 kV/480 V, 5% impedance transformer is tapped at 13.8 kV line where the Thevenin's equivalent impedance is ½ ohm. Determine the fault current at the primary for a three- phase fault at the secondary.

A. 10,500 A B. 3,300 A C. 4,200 A D. 6,050 A

Problem 891: EE Board October 1980

A 10 kVA, 110 V, 3- phase, 4- wire, 60 Hz alternator generates 70 volts per phase when excited to give rated voltage at full load. The armature synchronous impedance per phase is 0.2 ohm. What is the current in each phase if the generator terminals are short- circuited?

A. 350 A B. 875 A C. 620 A D. 534 A

Problem 892: EE Board October 1998

At a certain point of the network the positive, negative and zero sequence impedances are 0.25 p.u., 0.25 p.u. and 0.3 p.u. respectively. The base MVA is 100. The voltage level at that point is 34.5 kV. Determine the zero sequence current for a one line to ground fault.

A. 622755 A B. 8132 A C. 7516 A D. 2091 A

Problem 893:

In a short circuit analysis, the positive, negative and zero impedances are 0.20 pu, 0.20 pu and 0.25 pu, respectively, using a base MVA of 50. Estimate the fault current on the faulted lines if the double line to ground fault at the 138 kV level occurs.

A. 1204 A B. 1011 A C. 1090 A D. 1104 A

Problem 894:

A 15 MVA, 6,600 V, 60 Hz, Y- connected synchronous alternator has a positive, negative and zero sequence per unit reactance of 0.20, 0.20 and 0.10 respectively. The neutral of the generator is grounded through a reactor with a per unit reactance of 0.05 based on the generator rating. If a double line to ground fault occurs at the alternator terminals, estimate the current that flows in the reactor.

A. 5920 A B. 5623 A C. 6125 A D. 6342 A

Problem 895: EE Board March 1998

In a short circuit study, the positive, negative and zero sequence impedance are 0.25 pu and 0.25 pu and 0.3 pu, respectively. The base MVA is 100. Determine the fault current for a three- phase fault at the 115 kV level.

A. 3000 A B. 2000 A C. 2500 A D. 3500 A

Problem 896:

A three- phase 220- V, Y- connected alternator has a synchronous impedance of 0.15 + j2 ohms per phase. The alternator is connected through a short transmission line whose impedance per wire is 2 + j1 ohms to a Y- Y connected transformer bank whose total equivalent impedance referred to the secondary (high side) is 50 + j86.6 ohms. A three- phase load is connected from the secondary side of the bank through a transmission line whose impedance is 50 + j75 ohms per wire. If a symmetrical three- phase fault occurs at the load side, how much is the current will flow to the alternator windings. Assume the bank has a transformation ratio of 1:10.

A. 22.73 A B. 23.66 A C. 21.54 A D. 24.15 A

Problem 897: EE Board April 1984, EE Board April 1987

Three single- phase transformers each rated 50 kVA, 2400 volts primary, 277 volts secondary, four (4) percent impedance have their primaries connected in delta and secondaries in wye. Calculate the fault current drawn if a short circuit occurs between two phases at the secondary terminals.

A. 2260 A B. 2585 A C. 2036 A D. 2256 A

Problem 898: EE Board October 1986

La Tondeña Distillery Inc., located in Canlubang, Calamba, Laguna installed an emergency 3- phase generator, 3- wire GM generator is rated 350 kVA, 460 volts, 60 Hz with a reactance of 8%. Solve for the symmetrical 3- phase short circuit.

A. 5,321 A B. 5,703 A C. 5,284 A D. 5,491 A

Problem 899: EE Board October 1997

A 15 MVA, 34.5 kV/6.24 kV transformer is connected at an infinite bus. The percent impedance of the transformer is 2.5%. What is the current at the 34.5 kV side for a three phase short at the 6.24 kV side?

A. 55,500 A B. 10,000 A C. 5,000 A D. 25,000 A

Problem 900: EE Board April 1985

A three- phase, 3- wire generator is rated 325 kVA, 480 volts, 60 Hz with a reactance of eight (8) percent. Solve for the fault current delivered y the generator during a 2- phase short circuit at the terminals.

A. 4232 A B. 4462 A C. 4012 A D. 4156 A

Problem 901:

The secondary side of 5 MVA, 34.5/13.8 kV, 3- phase transformer is connected to a bus bar served by a 20 MVA, 13.8 kV, 3- phase alternator. The primary side of the transformer is tapped from an infinite bus. Estimate the fault current delivered to a 3- phase fault near the common bus bar. The transformer and alternator have 4% and 7.5% reactance, respectively.

A. 12,760 A B. 18,900 A C. 15,340 A D. 16,400 A

Problem 902:

Determine the minimum rupturing capacity of the circuit breaker as shown, if a three- phase symmetrical fault occurs at point P.

A. 30 MVA B. 20 MVA C. 10 MVA D. 15 MVA

Problem 903:

Given the one line diagram as shown, determine the current delivered by generator A when a three- phase fault occurs at point P.

A. 172.5 A B. 167.1 A C. 145.5 A D. 198.4 A

Problem 904:

Given the one line diagram as shown, determine the reactance of the limiting reactor x in order to limit the three- phase symmetrical fault power at point P to 400 MVA.

A. 0.65 Ω B. 0 Ω
B. 0.52 Ω
C. 0.46 Ω

TEST 25 - ILLUMINATION

Problem 905: EE Board April 1992

A piece of paper lies on the table 2m away from a point directly below a bulb of 100 cd and is 4 m above the table. Calculate the illumination on the center of the paper in lux.

A. 5.2 B. 6.7 C. 4.5 D. 3.4

Problem 906:

An unshaded lamp is 6 m above a table. It is lowered down by 2 m. By how much is the illumination on the table increased?

A. 2.0 times B. 2.25 times
C. 2.50 times D. None of these

Problem 907: EE Board April 1989

A medium unshaded lamp hangs 8 m directly above the table. To what distance should it be lowered to increase the illumination to 4.45 times to its former value?

A. 4.02 m B. 3.86 m C. 3.79 m D. 4.21 m

Problem 908:

An unshaded lamp is placed 95 cm from the screen of a photometer. If a glass is placed between the screen and the lamp, the lamp must be moved 5 cm closer to the screen to produce the same illumination as before. The glass blocks what percent of the light produced by the lamp?

A. 11.5% B. 10.2% C. 12.4% D. 9.08%

Problem 909: EE Board April 1994

A floodlight emitting 25,000 candelas in the center of its beam is aimed at 60° to a point on the ground 20 meters away. The illumination of the point in lux is

A. 54.12 B. 62.5 C. 31.25 D. 625

Problem 910:

An unknown lamp placed 6 m from a photometer screen provides the same illumination as a 90-cd lamp placed 4 m from the screen. What is the candlepower of the unknown lamp?

A. 202.5 cd B. 215.2 cd
C. 211.6 cd D. 208.4 cd

Problem 911:

Two lamps A and B having intensities of 300 cp and 500 cp respectively are situated 12 ft apart. A screen is placed between them in order that the illuminations on any sides are equal. How much is this illumination?

A. 11.45 fc B. 10.92 fc
C. 12.45 fc D. 13.15 fc

Problem 912: EE Board April 1985

A light is to be placed on a wall in order to obtain maximum brightness of illumination. To achieve this brightness, how high on the wall should this light bulb be placed to a point on the floor that is 3.6 m from the wall?

A. 2.54 m B. 2.25 m C. 2.08 m D. 2.86 m

Problem 913:

Two lamps x and y are hanged at a distance of 20 ft between their centers and 10 ft above the working surface. Lamp x gives 140 cp while lamp y gives 230 cp. At what distance from a point directly below lamp A on the line joining their centers will the two lamps give equal amount of illumination?

A. 8.22 ft B. 8.34 ft C. 8.05 ft D. 8.72 ft

Problem 914:

A 100- cd lamp, which emits light uniformly in all directions, is suspended 2.5 m above the center of the working table, which is 3 m square. Calculate the illumination at each corner of the table.

A. 29.56 lux B. 26.63 lux
C. 24.94 lux D. 28.38 lux

Problem 915: EE Board October 1991

A lamp of 500 cd is placed at the center of a room, 20 m x 10 m x 5 m. calculate the illumination in each corner of the floor.

A. 0.83 lux B. 0.81 lux
C. 0.78 lux D. 0.98 lux

Problem 916:

Four lamps are suspended 6 m above the ground at the corner of the lawn 4 m on each side. If each lamp emits 250 cd, calculate the illumination at the center of the lawn.

A. 20.56 lux B. 22.34 lux
C. 21.62 lux D. 19.85 lux

Problem 917: EE Board October 1991

A lamp of 500 cd power is placed at the center of a room, 20 m x 10m x 5 m. Calculate the illumination in a point in the middle of a 10 m wall at a height of 2 m from the floor.

A. 4.75 lux B. 4.98 lux
C. 4.69 lux D. 4.88 lux

Problem 918: EE Board October 1992

Luminaries of 2000 lumens output will be installed in a room. The desired illumination is 200 foot-candle. The coefficient of utilization is 0.45 and maintenance factor is 90%. Determine the number of luminaries needed if the size of the room is 120 m^2.

A. 30 B. 28 C. 32 D. 36

Problem 919:EE Board October 1993

A hall 35 x 20 m is to be provided with a general illumination of 130 flux. If the depreciation factor is 1.4 and the coefficient of utilization is 0.50, determine the number of fluorescent lamp required. Assume luminous efficiency of the fluorescent tube as 50 lumens per watt for 80-watt lamp.

A. 62 lamps B. 65 lamps C. 63 lamps D. 64 lamps

Problem 920:EE Board April 1990

A hall 30 m long and 12 m wide is to illuminated and the illumination required is 50 meter-candles. Calculate the number of lamps required taking a depreciation factor of 1.3 and utilization coefficient of 0.5 given that the output of the lamp to be used is rated 100 W, 1615 lumens.

A. 30 B. 29 C. 28 D. 27

Problem 921:EE Board April 1993

A room 20 m x 10 is to be illuminated by eight lamps and the average illumination is to be 50 lumens per square meter. If the utilization factor is 0.48 and depreciation factor 1.2, calculate the mean spherical power per lamp.

A. 249 cp B. 255 cp C. 235 cp D. 224 cp

Problem 922:EE Board October 1991

It is required to provide an illumination of 150 meter-candle in a factory hall 45 m x 15 m. Assume that the depreciation factor is 0.80, coefficient of utilization is 0.40 and efficiency of the lamp is 20 lumens per watt. Calculate the number of 250 W lamps.

A. 60 B. 62 C. 63 D. 61

Problem 923:EE Board March 1998

The illumination of a room is being designed. The data as follows:

Room length = 30 ft Room width = 20 ft
Coefficient of utilization = 0.6 Maintenance factor = 70%
Required foot-candle = 50 Lumens per lamp = 3300
Watts per lamp = 53 Voltage = 220
Power factor = 75%
What is the total current of the lamp required to satisfy the requirement?

A. 21 A B. 15 A C. 7 A D. 25 A

Problem 924:EE Board October 1989

The floor area of a room is 10 meters by 10 meters. The desired illumination level is 150 lux. Assume the coefficient of utilization is 0.51, the maintenance factor is 0.95 and in the market a fluorescent luminaire provide 1200 lumens output of light. Determine the number of luminaires needed for the room.

A. 24 lamps B. 28 lamps C. 25 lamps D. 26 lamps

TEST 26 – ELECTRICAL POWER PLANT

Problem 925:EE Board March 1998

A deep well pumps water into an open reservoir at the rate of 100 gpm. The water table is 200 ft below the output pipe. The system has an overall efficiency of 70%. What shall be the minimum hp of the pump?

A. 5.3 hp B. 8.7 hp C. 12.4 hp D. 7.2 hp

Problem 926:EE Board March 1998

A pump requires 100 hp to move water with a specific gravity of 1.0 at a certain flow rate to a given elevation. What horsepower does the pump require if the flow rate and elevation conditions are the same but the fluid pumped has a specific gravity of 0.8?

A. 80 hp B. 100 hp C. 60 hp D. 120 hp

Problem 927:EE Board April 1993

An electric motor is used to pump water from a well 40 ft deep. The amount of water pumped per hour to the ground level is 237,000 gallons. What is the hp of the motor assuming there is no power loss?

A. 43 hp B. 42 hp C. 41 hp D. 40 hp

Problem 928:

A pump, driven by 440 V, 3-phase induction motor lifts 1,100 cubic feet of water per minute against a total head of 100 ft of water. The efficiency of the pump and that of its motor are 0.75 and 0.92 respectively. The power factor of the motor is 0.9. Calculate the cost of operating the pump for 24 hours a day duty when power costs per P 0.30 per kW-hr.

A. P 1,723 B. P 2, 035 C. P 1,619 D. P 1, 905

Problem 929:EE Board October 1983, EE Board October 1990

A natural waterfalls, 50 meters high, consistently discharges 1.3 m^3 per second. A mini hydroelectric plant is to be constructed at the bottom of the waterfalls. Calculate the electric generator kW rating, assuming 90% mechanical to electrical conversion efficiency and water turbine design efficiency of 70%.

A. 401.72 B. 410.55 C. 420.42 D. 425.10

Problem 930:EE Board March 1998

A power plant gets water from a dam from a height of 122.45 m at the rate of 1000 cubic meters per minute. If the output of the plant is 15,000 kW, what is the plant efficiency?

A. 80% B. 70% C. 75% D. 65%

Problem 931:EE Board April 1995

Calculate the current taken by a motor at 440 V having an efficiency of 90%. Moreover the motor is used to drive a pump, which lifts 240,000 kg of water per hour to a height of 30 meters. The pump is given to be 80% efficient.

A. 58 A B. 75 A C. 83 A D. 62 A

Problem 932:EE Board April 1994

A three-phase motor driven pump at 1,800 rpm is discharging 500 gpm of water at a head of 25 meters. The pump efficiency is 75%. Determine the hp of the motor.

A. 15 hp B. 12 hp C. 14 hp D. 10 hp

Problem 933:EE Board April 1993

A hydroelectric station has a turbine efficiency of 80% and a generator efficiency of 85%. Determine the volume of water required when delivering a load of 40 MW for 6 hours if its effective head is 120 m. Water weighs 1200 kg/m^3.

A. 899,424 m^3 B. 945,352 m^3 C. 845,041 m^3 D. 905,412 m^3

Problem 934:

A hydroelectric power plant is to be constructed. The place has an annual rainfall of 190 cm. The available catchment area is 250 sq. km with an available head of 30 meters. On the average, only 85% of the rainfall can be collected in and 70% of the impounded water is available for power. Assuming turbine and generator efficiencies of 80% and 92% respectively, what will be the average power generated.

A. 2,637.5 kW B. 1,737.7 kW C. 1,941.2 kW D. 2,063 kW

Problem 935:EE Board June 1990, EE Board April 1991

A 100 MW hydroelectric station is supplying full load for 10 hrs. in a day. Calculate the volume of water, which has been used. Assume effect effective head of the water as 200 m and the overall efficiency of the station as 80%. Assume 1 m^3 of water = 1000 kg.

A. 2,232,435 m^3 B. 2,293,560 m^3
C. 2,345,456 m^3 D. 2,371,402 m^3

Problem 936:

A farmer has a small stream on his property, which he thinks might supply enough power to light his farm load. The stream was found to be flowing at 0.05 m^3/sec. The available fall is 5 m. a small hydraulic turbine and generator will have a combined efficiency of 75%. Assuming a transmission line efficiency of 82%, how many 50-W lamps can be served by the generator simultaneously?

A. 28 lamps B. 32 lamps C. 36 lamps D. 30 lamps

Problem 937:EE Board April 1994

A waterfall is 60 meters high. It discharges at a constant rate of 1.0 cubic meter per second. A mini-hydro electric plant is to be constructed below the waterfalls. The turbine efficiency is 80% and the generator efficiency is 95%. Calculate the kW output of the generator.

A. 447.34 kW B. 464.22 kW C. 457.27 kW D. 471.30 kW

Problem 938:EE Board April 1989

Maria Cristina falls located at south has a height of 100 meters, it discharges at constant rate 2.5 m^3/sec. National Power corporation has construct a hydroelectric plant below the water falls. If the turbine efficiency is 70% and generator efficiency is 90%, calculate the annual energy in kW-hr, if the discharge rate is constant throughout the year. Assume specific gravity constant.

A. 13,534,857 B. 13,467,546
C. 13,655,654 D. 13,504,231

Problem 939:EE Board October 1983, EE Board October 1990

A natural waterfall, 50 meters high, consistently discharges 1.3 m^3 per second. A mini hydroelectric plant is to be constructed at the bottom of the waterfalls. Calculate the annual energy in kW-hr that can be generated by the power plant. Assume the turbine and generator efficiencies equal to 70% and 90%, respectively.

A. 3,519,067 B. 3,62,356
C. 3,612,212 D. 3,345,815

Problem 940:

A water turbine operating at 85% efficiency is under a head of 100 m. If the constant discharge is 1000 gal/sec, evaluate the operating speed of the turbine.

A. 640 rpm B. 654 rpm C. 636 rpm D. 608 rpm

Problem 941:

A mini- hydroelectric power plant is under a head of 275 feet. The turbine efficiency is 0.85 and the generator efficiency is 0.80. If the turbine speed is limited to 450 rpm, calculate the generator kW output.

A. 3402 B. 3948 C. 4024 D. 3902

Problem 942: EE Board October 1997

A power plant gets water from a dam from a height of 100 meters at the rate of 1000 cubic meters per minute. If the overall efficiency of the plant is 75%, what is the kW output of the plant?

A. 7,550 kW B. 15,250 kW C. 12,250 kW D. 5,250 kW

Problem 943: EE Board October 1997

A power plant consumes 100,000 pounds of coal per hour. The heating value of the coal is 12,000 BTU per pound. The overall plant efficiency is 30%. What is the kW output of the plant?

A. 105,500 kW B. 205,000 kW

C. 142,500 kW D. 175,000 kW

Problem 944:

A power plant has a fuel consumption of 1 pound per kW-hr generated. Determine the heating value of the fuel used in BTU per pound. The overall efficiency of the plant is 36%.

A. 10,000 B. 9,500 C. 9,800 D. 10,050

Problem 945: EE Board October 1998

A certain coal- fired power plant has a heat rate of 2.88×10^6 calories per kW- hr. Coal costs P 2,500 per ton. How much is the fuel cost component of producing 1 kW-hr? Assume the heating value of coal used equal to 13,000 BTU/lb.

A. P 2.50 B. P 1.75 C. P 1.00 D. P 1.25

Problem 946:

A 100 MW thermal plant has an overall efficiency of 34%. If the coal used has a heating value of 10,800 BTU per pound, calculate the coal consumption of the plant per kW-hr output.

A. 0.84 lb B. 0.96 lb C. 0.89 lb D. 0.93 lb

Problem 947: EE Board October 1997

A coal power plant has an overall plant efficiency of 28%. Coal with a heating value of 12,000 BTU per pound cost P 1.50 per pound. What is the fuel cost pf producing one kW-hr?

A. P 1.90 B. P 1.52 C. P 1.75 D. P 1.62

Problem 948:

A power plant has an overall efficiency of 30%. If this plat can consumed 4200 kilograms of coal per hour, estimate the total electric energy produced in one day. Assume the calorific value of the coal being used is 8000 kcal per kilogram.

A. 183 MW-hr B. 168 MW-hr
C. 155 MW-hr D 176 MW-hr

Problem 949: EE Board April 1994

A plant has a total operating capacity of 800 kW. The coal consumption is 1900 lbs per hour. The heating value of the coal is 9500 BTU per lb. What approximate percent of the heat in the coal is converted into useful energy?

A. 12.3 B. 15.0 C. 8.7 D. 17.5

Problem 950: EE Board October 1997

A 100 MW coal- fired power plant has an average heat rate of 9500 BTU per kW-hr. the plant load factor is 75%. The heating value of the coal is 12,000 BTU per pound. Calculate the amount of coal usage for one day.

A. 1.425×10^6 pounds B. 2.235×10^6 pounds
C. 2.235×10^5 pounds D. 1.826×10^6 pounds

Problem 951: EE Board October 1998

A diesel generator set burns diesel with a heating value of 18,000 BTU per pound. The diesel engine has an efficiency of 30% and the alternator has an efficiency of 95%. Determine the fuel cost component of producing one kW-hr if diesel costs P 2.80 per pound.

A. P 0.15 B. P 3.28 C. P 2.15 D. P 1.86

Problem 952:

A diesel electric generating unit supplies a load at 70 kW. The heating value of the oil used is 12,000 kcal per kg. If the overall efficiency of the unit is 40% determine the mass of oil required per hour.

A. 11.8 kg B. 10.3 kg C. 12.5 kg D. 9.67 kg

Problem 953: EE Board April 1993

A 500 kW electric lighting cost P 1000 per kW installed. Fixed charges are 14%, operating cost is P 1.50 per kW-hr. The plant averages 150 kW for 5000 hours of the year, 420 kW for 1000 hrs and 20 kW for the remainder. What is the unit cost production of electric energy?

A. P 1.96 B. P 1.84 C. 2.15 D. 2.05

Problem 954:EE Board October 1989

A coil fired Power Plant with 3000 kW rated capacity costs P 15,000 per kW installed. Annual operating cost p 12 million; annual maintenance cost P 8 million; annual depreciation P 15 million; interest on investment per year 8% and cost of coal P 800 per ton. If one pound of coal is needed to generate 1 kW-hr, find the total annual cost to operate the plant. Plant capacity factor is 50%.

A. P 46.45 million B. P 43.38 million C. P 40.28 million D. P 42.32 million

Problem 955:EE Board October 1998

To produce one kW-hr, a power plant burns 0.9 lb of coal with a heating value of 13,000 BTU. What is the heat rate of the plant?

A. 6,250 BTU/kw-hr B. 9,550 BTU/kw-hr
C. 11,700 BTU/kw-hr D. 8,700 BTU/kW-hr

Problem 956: EE Board March 1998

The current loads of four circuits are as follows:

Circuit No.1 = 25 amperes
Circuit No. 2 = 38 amperes
Circuit No. 3 = 18 amperes
Circuit No. 4 = 45 amperes

If the diversity factor is 1.5, what is the minimum ampacity of the feeder conductor?

A. 126 A B. 189 A C. 84 A D. 152 A

Problem 957: EE Board October 1998

The power costumer has four feeder circuits of 220 V, three- phase. The circuits have maximum demand as follows:

Circuit no. 1 = 35 A Circuit no. 3 = 72 A
Circuit no. 2 = 46 A Circuit no. 4 = 57 A

The diversity factor is 1.5, determine the maximum kVA demand with the costumer.

A. 46 B. 26.5 C. 80 D. 53

Problem 958: EE Board April 1980

A substation transformer is to serving the following loads:

Classification	Total load	Demand factor
Lighting	300 kW	60%
Power	1200 kW	80%
Heating	500 kW	90%

If the diversity factor among the load types is 1.5, determine the maximum demand on the transformer.

A. 2000 kW B. 1060 kW
C. 1225 kW D. 1180 kW

Problem 959: EE Board October 1998

The power costumer has four circuits of 220 V, three- phase. The circuits having maximum demand as follows:

Circuit no. 1 = 35 A Circuit no. 2 = 46 A
Circuit no. 3 = 72 A Circuit no. 4 = 57 A

The diversity factor is 1.5 A, the load factor is 50% and the power factor is 80%. What is the approximate kW demand of the costumer?

A. 15 kW B. 43 kW C. 21 kW D. 53 kW

Problem 960:

An industrial plant has an aggregate load of 100 kW. The demand factor is 60%. If the average total energy consumption of the plant in one year is 186 MW-hr, what I the yearly load factor of the plant?

A. 32.45% B. 42.25%
C. 38.67% D. 35.39%

Problem 961:

Power plant has two 75 MW generator sets each operating at 7200 hours per year and a 50 MW generator set operating at 3000 hours per year. If the plant output is 800 x 10^6 kW-hr per year, solve for the plant use factor.

A. 63.4% B. 65.0% C. 68.3% D. 70.6%

Problem 962:

The average weekly energy generated by a thermal plant is 7,000,000 kW-hr. The peak load of the plant is 75,000 kW during the week. If the plant has an installed capacity of 100 MW, solve for the load factor of the plant.

A. 48.92% B. 56.34%
C. 50.44% D. 55.55%

Problem 963: EE Board April 1990

A certain power plant has reserve capacity above the peak load of 10 MW. The annual factors are load factor = 59%, capacity factor = 41% and use factor = 46%. Determine the installed capacity.

A. 33.45 MW B. 31.85 MW
C. 32.77 MW D. 30.47 MW

Problem 964: EE Board April 1990

A certain power plant has reserve capacity above the peak load of 10 MW. The annual factor are load factor = 59%, capacity factor = 41% and use factor = 46%. Determine hours per year not in service.

A. 952 hours B. 965 hours
C. 924 hours D. 937 hours

Problem 965: EE Board April 1993

A central generating station has an annual factor report as follows:

Plant capacity factor = 50%
Load factor = 60%
Use factor = 45%
Reserved = 10,500 kW

Determine the rated capacity of the station.

A. 63,000 kW B. 60,000 kW
C. 65,000 kW D. 70,000 kW

Problem 966: EE Board October 1990

A 55,000 kW thermal plant of National Power Corporation delivers an annual output of 283,000,000 kW-hr with a peak load of 44 MW. What is the capacity factor?

A. 49.4% B. 42.4% C. 48.2% D. 44.6%

Problem 967:

A thermal power plant has two generating sets rated 600 kW and 800 kW respectively being operated at rated capacity. The total coal consumption is 680 kg per hour. If the coal has a heating value of 20,000 joules per gram, what fraction of heat produced from the coal is converted into useful electrical energy?

A. 37.06% B. 40.20%

C. 33.67% D. 38.28%

Problem 968: EE Board October 1998

The metering of a power customer was read and gave the following data:

kW-hr = 200,000 kVAR-hr = 180,000

Maximum Demand = 380 kW Billing Days = 30

What is the load factor?

A. 68% B. 73% C. 80% D. 62%

MISCELLANEOUS TOPICS – TEST 27

Problem 969: EE Board October 1986, EE Board October 1993

An electric truck is propelled by a DC motor driven by a 110- V storage battery. The truck is required to exert a tractive effort of 220 lb at a speed of 5-mph. The overall efficiency of the motor and drive is 70 percent. What current is taken from the battery?

A. 25.24 A B. 28.45 A

C. 30.22 A D. 26.18 A

Problem 970: EE Board October 1990

An electric motor driven conveyor belt 80 feet long is required to take 2,200 lbs of dirt, rocks, etc per minute from an excavation site and raise it 15 ft vertically. If all friction in the machinery is neglected, what hp of motor is required?

A. 1.5 B. 1.0 C. 2.0 D. 2.5

Problem 971: EE Board June 1990

An electric motor is needed to drive an escalator in a department store. The escalator is 36 in wide and can accommodate two (2) riders side by side hence the loading can be considered as uniformly distributed with 250 lb/ft. Linear speed is 80 ft/min. the escalator angle is 38^{o} and its lifting height is 6.5 meters. Mechanical efficiency of the system is 60%. Determine the motor size in hp.

A. 21.53 B. 22.01 C. 19.42 D. 20.84

Problem 972: EE Board June 1990

An electric lift is required to raise a load of 5 tonne through a height of 30 m. one quarter of the electrical energy supplied to the lift is lost in the motor and gearing. If the time required raising the load is 27 minutes find the current taken by the motor, the supply voltage being 230 V DC.

A. 4.83 A B. 3.42 A C. 5.26 A D. 6.05 A

Problem 973: EE Board October 1992, EE Board April 1994

A conveyor belt of length 15-m is at 35^{o} with respect to the ground or horizontal. It can hold 4,000 kg of ore over its total length and it travels the distance of its length in 30 seconds. Calculate the power rating of the motor in kW that drives the conveyor belt.

A. 10.50 kW B. 11.25 kW

C. 13.58 kW D. 12.75 kW

Problem 974: EE Board October 1998

What is the work in ergs needed to raise a 10-gram weight 100-m up?

A. 4.9×10^{5} B. 98×10^{7}

C. 9.8×10^{7} D. 1.96×10^{7}

Problem 975: EE Board October 1990

An electric lift makes120 double journeys in a day and a load of 6 tonnes is raised to a height of 100 m in one and a half minutes. In the return journey, the cage of the lift is empty and it completes the journey in 70

seconds. The weight of the cage is 600 kg and the counterweight is 3 tonnes. Calculate the horsepower of the motor. Assume the efficiency of the lift to be 80%.

A. 64.24 hp B. 65.75 hp
C. 58.70 hp D. 70.43 hp

Problem 976: EE Board October 1989

The power required by a plane flying at 545 km/hr is 1800 kW. Determine the average resisting force in Newtons.

A. 11,890 B. 12,420
C. 11,520 D. 12,670

Problem 977: EE Board October 1990

A train weighing 1600 tons is pulled up a 2% grade by 600-hp. Train resistance is 19200 lbs. What is the speed mph?

A. 22 B. 25 C. 32 D. 28

Problem 978:EE Board April 1993

A DC series motor operates a crane at normal voltage and lifts a load of 2- tonne at 50 m/min. Determine the speed at which it will lift a load of 5-tonne.

A. 30 m/min B. 20 m/min
C. 25 m/min D. 28 m/min

Problem 979: EE Board April 1994

How long could a 1000-hp motor be operated in the heat energy liberated by 1 cubic kilometer of ocean water when the temperature of the water is lowered by 1° C if all its heat were converted to mechanical energy?

A. 170 yrs B. 177 yrs
C. 182 yrs D. 188 yrs

Problem 980: EE Board October 1991

Calculate the minimum rms HP required of an open type electric motor which operates at 15 HP load for 8 minutes, 10 HP load for 6 minutes, 20 HP for 6 minutes and the motor is at rest for 12 minutes after which the cycle is repeated.

A. 15.00 B. 12.25 C. 10.32 D. 16.75

Problem 981: EE Board October 1993

A transformer is designed to carry 30 times its rated current for 1 second. The length of time that a current of 20 times the rated current can be allowed to flow is

A. 0.67 sec B. 2 sec
C. 1.5 sec D. 2.25 sec

Problem 982: EE Board October 1997

A three- phase motor draws 50 A of current at full load. What shall be the maximum inverse-time circuit breaker that may be used for short circuit protection?

A. 50 A B. 100 A C. 125 A D. 75 A

Problem 983: EE Board October 1990

A synchronous condenser costs P 1000 per kVA. If a consumer is charged at P 625 per annum per kVA of maximum demand and the interest and depreciation charges are 10% on the capital invested, determine his most economical operating power factor. The power factor of the consumer load is 0.780 lagging. Assume no losses in the synchronous condenser.

A. 0.998 B. 0.988
C. 0.989 D. 0.986

Problem 984: EE Board April 1982

In a group of 3 motors, one draws 15 A, the other 40 A and the third 52 A. What size of conductor in terms of ampacity must be used for the feeder circuit?

A. 120 A B. 107 A C. 134 A D. 160 A

Problem 985: EE Board October 1992

Given the following three- phase induction motors operating at full load.

15-hp, 220 V, 0.95 eff., 0.80 pf
25-hp, 220 V, 0.90 eff., 0.707 pf
20 hp, 220 V, 0.92 eff., 0.866 pf

Determine the ampacity of the feeder circuit conductors supplying these motors.

A. 178.46 A B. 183.93 A
C. 164.70 A D. 205.07 A

Problem 986: EE Board April 1982

A single- phase motor has rated full- load current of 28 amperes. How large must be the ampacity of the fuses to be used?

A. 35 A B. 42 A C. 70 A D. 84 A

Problem 987: EE Board October 1998

What surge arrester's nominal rating shall you recommend to protect distribution transformer in a 34.5 kV grounded system?

A. 34.5 kV B. 30 kV
C. 22 kV D. 27 kV

Problem 988: EE Board April 1991

An induction motor is equipped with a flywheel of moment of inertia of 4 kg-m^2 for driving a rolling mill. If the speed of the induction motor is 1000 rpm, what extra energy the flywheel is capable of supplying when the load comes to the motor?

A. 22 kJ B. 20 kJ C. 28 kJ D. 32 kJ

Problem 989: EE Board October 1992

A three- phase, 220 V, 60 Hz induction motor drives a fan, which provides 40 m^3/ sec air requirements to a furnace. Assume fan efficiency of 60% and 150 mm H_2O gauge pressure. Determine the line current drawn by the motor if efficiency and power factor is 80% and 70% respectively.

A. 460 A B. 474 A C. 482 A D. 442 A

Problem 990:EE Board October 1998

A ten- year investigation of a river's potential gave an average water flow of 25 cm per second at the bottom and 90 cm per second at the surface. The average cross- section at the same location is 80 sq. m. what is the average flow rate in cubic meter per hour?

A. 165,600B. 46 C. 57,500 D. 2,760

Problem 991: EE Board April 1993, EE Board October 1994

A 50 kW electric lighting costs P 1000 per kW installed. Fixed charges are 14%, operating cost is P 1.50 per kW-hr. The plant averages 150 kW for 5000 hours of the year, 420 kW for 1000 hours and 20 kW for the remainder. What is the unit cost of producing electric energy?

A. P 2.10 B. P 1.96 C. P 2.01 D. P 1.82

Problem 992: EE Board October 1990

If the power gain in a circuit is 20 decibels. What is the actual ratio of the output to input power?

A. 200 B. 100 C. 20 D. 10

Problem 993: EE Board October 1990

If 20 decibels were power losses, what is the power output to input ratio?

A. 0.05 B. 0.01 C. 10 D. 5

Problem 994: EE Board October 1992

What is the output of a 27-dB gain amplifier whose input power is 25μW?

A. 12.53 mW B. 11.24 mW

C. 15.62 mW D. 14.05 mW

Problem 995: EE Board April 1991

It is desired to deposit a thickness of 1 mm of nickel on the surface of a worn steel pin 10 inches long and 4 inches in diameter. The available current is 50 A. the electromechanical equivalent of nickel is 0.00038 gm/coulomb and its relative density is 8.9. Calculate the time required.

A. 11.32 hrs B. 12.65 hrs

C. 10.08 hrs D. 9.55 hrs

Problem 996: EE Board October 1987

The use of electricity for melting a snow in a driveway 10 ft wide by 30 ft long is being considered. At a 0.20 cents a kilowatt-hour, what would be the cost of melting 6 inches of snow? Assume the following data: specific weight of snow, 10 lb per cu. Ft, efficiency of operation, 50%.

A. P 20.25 B. P 25.35

C. P 28.40 D. P 30.63

Problem 997: EE Board April 1990

A car is being self started against a resisting torque of 60N-m and at each start the engine is cranked at 75 rpm for 8 seconds. For each start the energy is drawn from a lead acid accumulator. If the fully charged battery has a capacity of 100 wh per charge, calculate the number of starts that can be made with such a battery. Assume an overall efficiency of the motor and gears as 25%.

A. 26 B. 25 C. 20 D. 23

Problem 998: EE Board October 1990

In an electric heater, the inlet temperature is 15° C. Water is flowing at the rate of 300 grams per minute. The voltmeter measuring voltage across the heating element reads 120 volts and an ammeter measuring current taken reads 10 A. When steady state is finally reached, what is the final reading of the outlet thermometer?

A. 72.6 °C B. 81.2 °C

C. 75.3 °C D. 78.8 °C

Problem 999: EE Board April 1992

A 230- volt is supplied to an electric soldering machine which draws a current of 0.8 A, fifty-five percent (55%) of the heat generated is lost in heating other metal parts of the machine and in radiation. The copper-soldering tip weighs 150 grams.

Melting point of solder – 300 °C

Ambient temperature – 15 °C

Specific heat of copper – 0.094 cal/g-°C

Density of copper – 8.0 g/cc

Determine the time elapsed after switching on the machine before the soldering tip is heated to the melting point of solder and the machine ready for use.

A. 3.05 min B. 2.26 min

C. 3.37 min D. 4.24 min

Problem 1000: EE Board April 1990

A room measures 6 m x 6 m x 4 m. the air in it has to be renewed twice an hour and is to be maintained at least 15 °C above the incoming air temperature. Find the capacity of the heater assuming a loss of 10% of the heat. Assume air density as 12.8×10^{-4} grams per cubic cm and specific heat of air as 0.24 cal/g-°C.

A. 1706 W B. 1545 W

C. 1734 W D. 1621 W

Problem 1001: EE Board April 1990, EE Board October 1993

A foundation 30 ft long, 12 ft wide and 9 ft deep is to be composed of a 1:2:4 concrete. How much gravel in cubic yards will be required?

A. 150 B. 106 C. 110 D. 100