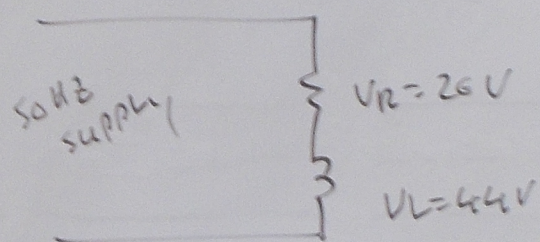




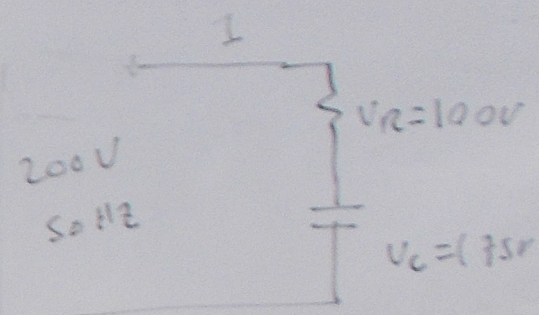
① FOR THE CIRCUIT BELOW DRAW THE VOLTAGE PHASOR DIAGRAM TO SCALE
MEASURE

- (a) CIRCUIT PHASE ANGLE
- (b) SUPPLY VOLTAGE



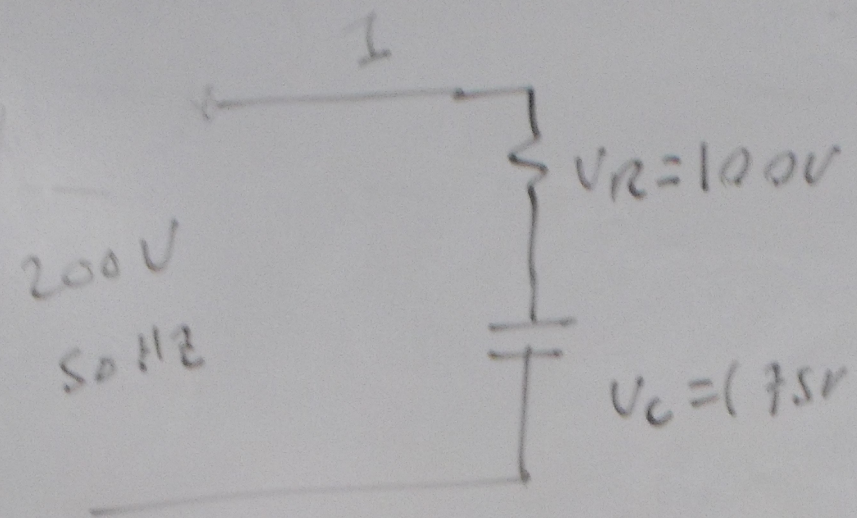
ALSO SOLVE THE PROBLEM BY CALCULATION

② DRAW TO SCALE THE PHASOR DIAGRAM FOR THE FOLLOWING CIRCUIT. INCLUDE PHASOR FOR V_R , V_C AND V_S .
STATE THE CIRCUIT PHASE ANGLE.



ALSO SOLVE THE PROBLEM

- ③ TOTAL VOLTAGE DROP
SERIES CIRCUIT MEASUREMENT
 $V_L = 70V$ AND $V_C = 100V$
- ④ DRAW TO SCALE THE PHASOR DIAGRAM REPRESENTING PHASE SUPPLY VOLTAGE AND
- ⑤ MEASURE AND STATE THE PHASE ANGLE FROM YOUR PHASOR DIAGRAM
- ⑥ MEASURE THE CIRCUIT PHASE ANGLE
- ALSO SOLVE THE PROBLEM BY CALCULATION



ALSO SOLVE THE PROBLEM BY CALCULATION

- ③ TOTAL VOLTAGE DROP ACROSS AN RLC SERIES CIRCUIT MEASURE $V_R = 55V$, $V_L = 70V$ AND $V_C = 120V$

- ④ DRAW TO SCALE THE PHASOR DIAGRAM REPRESENTING PHASE RELATIONSHIP BETWEEN SUPPLY VOLTAGE AND CURRENT

- ⑤ MEASURE AND STATE THE SUPPLY VOLTAGE FROM YOUR PHASOR

- ⑥ MEASURE THE CIRCUIT PHASE ANGLE

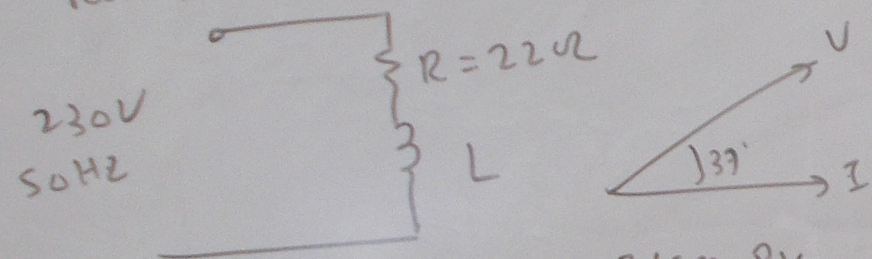
ALSO SOLVE THE PROBLEM BY CALCULATION

④ EXAMINE THE FOLLOWING CIRCUIT AND PHASOR DIAGRAM AND

① DRAW ITS IMPEDANCE TRIANGLE TO SCALE AND LABEL ALL SIDES.

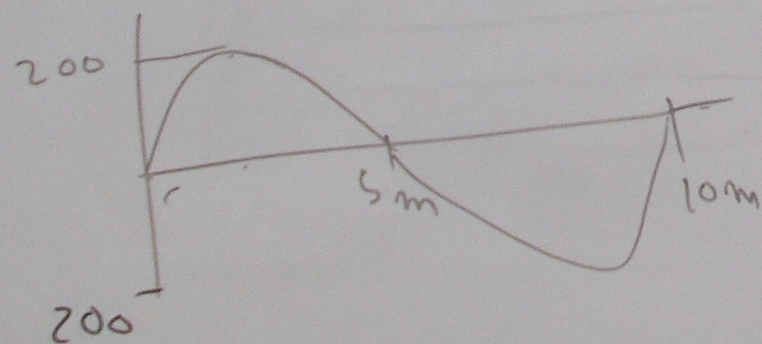
② MEASURE AND STATE THE VALUE OF IMPEDANCE

③ MEASURE AND STATE THE VALUE OF REACTANCE



ALSO SOLVE THE PROBLEM BY CALCULATION.

⑤ EXAMINE THE FOLLOWING WAVE FORM DETERMINING



① PEAK VOLTAGE ② FREQUENCY ③ PEAK TO PEAK VALUE

④ AVERAGE VOLTAGE OF POSITIVE HALF WAVE FORM

⑥ A SINGLE PHASE MOTOR WINDING HAS A MEASURED RESISTANCE OF 20Ω AND INDUCTANCE OF 180mH . WHEN CONNECTED TO 230V , 50Hz SUPPLY, DETERMINE THE

① INDUCTIVE REACTANCE ② IMPEDANCE ③ SUPPLY CURRENT

④ CIRCUIT PHASE ANGLE

⑦ A CAPACITIVE REACTANCE OF 300Ω AND RESISTOR OF 67Ω ARE CONNECTED IN SERIES ACROSS A 230V , 50Hz SUPPLY. CALCULATE THE

① CURRENT THROUGH THE COMPONENTS ② VOLTAGE ACROSS THE CAPACITOR

③ VOLTAGE ACROSS THE RESISTOR.

⑧ AN IDEAL INDUCTOR DRAWS A CURRENT 3A WHEN CONNECTED TO A 150V , 50Hz SUPPLY. DETERMINE THE INDUCTANCE VALUE OF COIL. (COIL RESISTANCE IS ZERO) IF THE COIL HAS 1Ω RESISTANCE AND DRAWS 3A FROM 150V SUPPLY, WHAT WILL BE ITS INDUCTANCE

⑨ AN RLC RESISTOR AND INDUCTOR CIRCUIT SUPPLY CALCULATE

⑩ A SERIES CIRCUIT WITH CAPACITOR $C = 7\mu\text{F}$ FREQUENCY

①

②

③

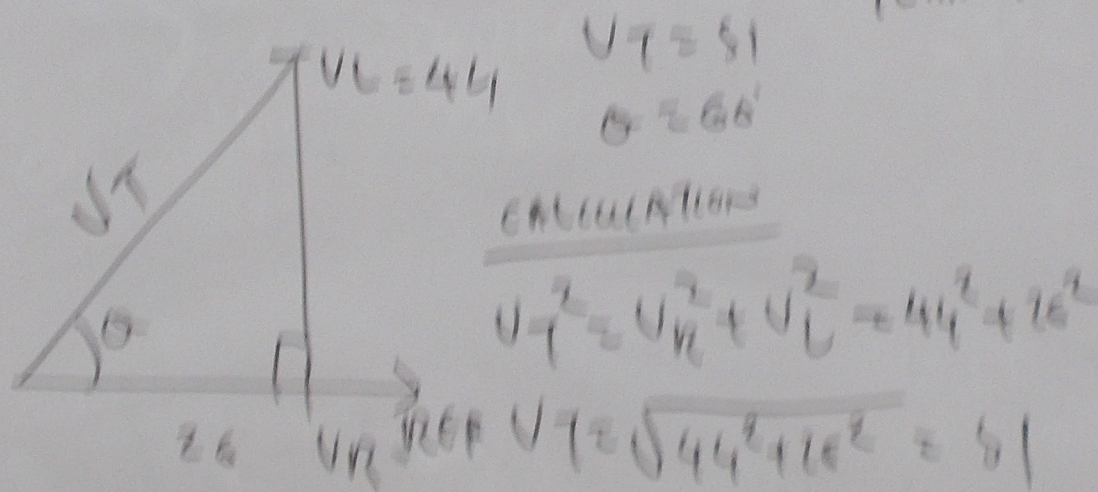
Q7) AN RLC SERIES CIRCUIT CONTAINS A 22Ω RESISTOR WITH CAPACITIVE REACTANCE 70Ω AND INDUCTIVE REACTANCE 165Ω . IF THE CIRCUIT WAS CONNECTED TO $230V$ $50Hz$ SUPPLY

- CALCULATE (a) CIRCUIT IMPEDANCE
(b) CIRCUIT CURRENT
(c) CIRCUIT PHASE ANGLE
(d) VOLTAGE DROP EACH COMPONENT

Q8) A SERIES CIRCUIT WHERE $R = 30\Omega$, $L = 90mH$ $C = 20\mu F$ IS CONNECTED TO $120V$ VARIABLE FREQUENCY SUPPLY. CALCULATE

- (a) RESONANT FREQUENCY (b) CIRCUIT CURRENT AT RESONANCE
(c) VOLTAGE ACROSS THE CAPACITOR AT RESONANCE

Q9)

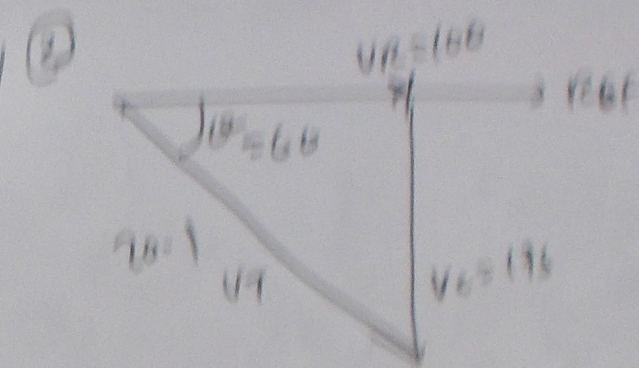


CALCULATION

$$V_T^2 = V_R^2 + V_L^2 = 44^2 + 26^2$$

$$V_T = \sqrt{44^2 + 26^2} = 51$$

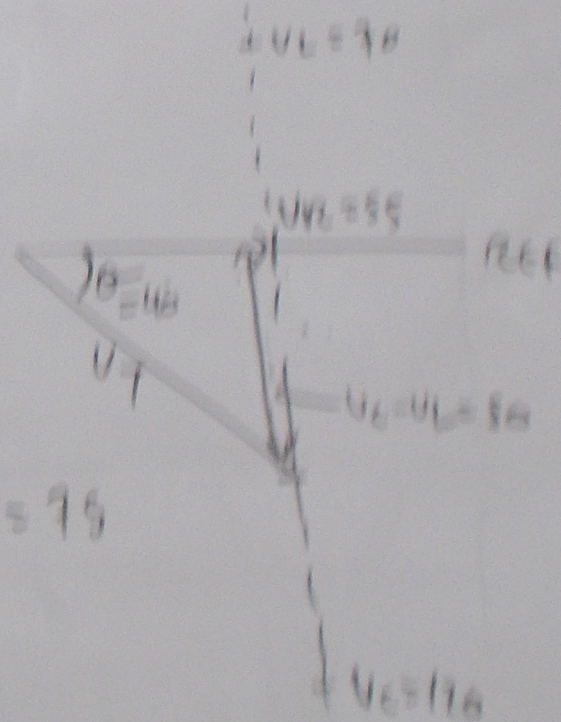
$$\theta = \tan^{-1} \frac{V_L}{V_R} = \tan^{-1} \frac{44}{26} = 60^\circ$$



$$V_T = \sqrt{V_R^2 + V_L^2} = \sqrt{160^2 + 195^2} = 251.55 V$$

$$\theta = \tan^{-1} \frac{195}{160} = -60.2^\circ$$

Q10)

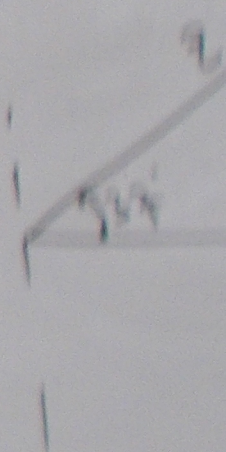


$$V_T = 79$$

$$V_T = \sqrt{V_R^2 + V_L^2} = \sqrt{55^2 + 78^2} = 94.5$$

$$\theta = \tan^{-1} \frac{V_L}{V_R} = \tan^{-1} \frac{78}{55} = 54.5^\circ$$

Q11)



Draw Top

②

$$V_T = \sqrt{V_R^2 + V_C^2} = \sqrt{100^2 + 175^2} = 201.55 \text{ V}$$

$$\theta = -\tan^{-1} \frac{175}{100} = -60.2^\circ$$

③

$$V_T = 75$$

$$V_T = \sqrt{V_R^2 + (V_C - V_L)^2}$$

$$= \sqrt{55^2 + 50^2}$$

$$= 74.5$$

$$\theta = -\tan^{-1} \frac{V_C - V_L}{V_R}$$

$$= -\tan^{-1} \frac{50}{55} = -42.2^\circ$$

④

LOCATE RESISTANCE
SET 37°
DRAW THE LINE
IT IS 'Z'
DRAW VERTICAL LINE FROM
TOP OF RESISTANCE

MEASURE Z AND X_L

$$Z = 27.4 \Omega$$

$$X_L = 16.6 \Omega$$

$$\tan \theta = \frac{X_L}{R}$$

$$\tan 37^\circ = \frac{X_L}{22} \rightarrow X_L = 22 \tan 37^\circ = 16.6 \Omega$$

$$Z = \sqrt{R^2 + X_L^2} = \sqrt{22^2 + 16.6^2} = 27.4 \Omega$$

⑤ (a) $V_{\text{PEAK}} = 200 \text{ V}$

(b) $T = 10 \text{ ms} = 10 \times 10^{-3} \text{ sec}$

$$f = \frac{1}{T} = \frac{1}{10 \times 10^{-3}} = \frac{10^3}{10} = 100 \text{ Hz}$$

(c) $V_{\text{P-P}} = 400 \text{ V}$

(d) $V_{\text{AVG}} = \frac{V_{\text{PEAK-PK}}}{\pi} = \frac{400}{3.1416} = 127.4 \text{ V}$

⑥ $R = 20 \Omega$

$$V = 230 \text{ V}$$

(a) $X_L = 2 \pi f L$

(b) $Z = \sqrt{R^2 + X_L^2}$

(c) $I = \frac{V}{Z}$

(d) $\theta = \tan^{-1} \frac{X_L}{R}$

⑦ $R = 6 \Omega$

$$I = \frac{V}{Z} =$$

$$V_R = I R$$

$$V_C = I X_C$$

⑧ $V = 150 \text{ V}$

$$X_L = \frac{V}{I}$$

$$2 \pi f L =$$

Find Z and X_L

$$Z = 27.4 \Omega$$

$$X_L = 16.6 \Omega$$

$$\theta = \frac{X_L}{R}$$

$$37 = \frac{X_L}{22} \rightarrow X_L = 22 \tan 37 = 16.6 \Omega$$

$$\sqrt{R^2 + X_L^2} = \sqrt{22^2 + 16.6^2} = 27.4 \Omega$$

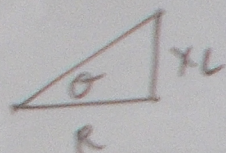
$$V_{\text{PEAK}} = 200 \text{ V}$$

$$= 10 \text{ ms} = 10 \times 10^{-3} \text{ sec}$$

$$\frac{1}{T} = \frac{1}{10 \times 10^{-3}} = \frac{10^3}{10} = 100 \text{ Hz}$$

$$P-P = 400 \text{ W}$$

$$V_{\text{AVG}} = \frac{V_{\text{PEAK}} - P_{\text{PEAK}}}{\pi} = \frac{400}{3.1416} = 127.4 \text{ V}$$



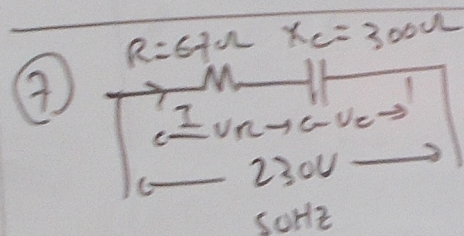
⑥ $R = 20 \Omega$ $L = 180 \text{ mH} = 0.18 \text{ H}$
 $V = 230 \text{ V}$ $f = 50 \text{ Hz}$

(a) $X_L = 2\pi fL = 2 \times 3.1416 \times 50 \times 0.18 = 56.55 \Omega$

(b) $Z = \sqrt{R^2 + X_L^2} = \sqrt{20^2 + 56.55^2} = 60 \Omega$

(c) $I = \frac{V}{Z} = \frac{230}{60} = 3.8 \text{ A}$

(d) $\theta = \tan^{-1} \frac{X_L}{R} = \tan^{-1} \frac{56.55}{20} = 70.5^\circ$



$$Z = \sqrt{R^2 + X_C^2} = \sqrt{67^2 + 300^2} = 307.4 \Omega$$

$$I = \frac{V}{Z} = \frac{230}{307.4} = 0.748 \text{ A}$$

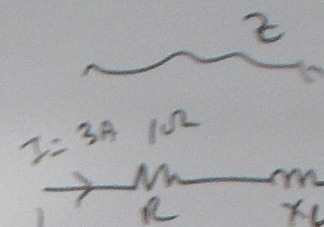
$$V_R = IR = 0.748 \times 67 = 50 \text{ V}$$

$$V_C = IX_C = 0.748 \times 300 = 224 \text{ V}$$

⑧ $V = 150 \text{ V}$, $f = 50 \text{ Hz}$ $I = 3 \text{ A}$

$$X_L = \frac{V}{I} = \frac{150}{3} = 50 \Omega$$

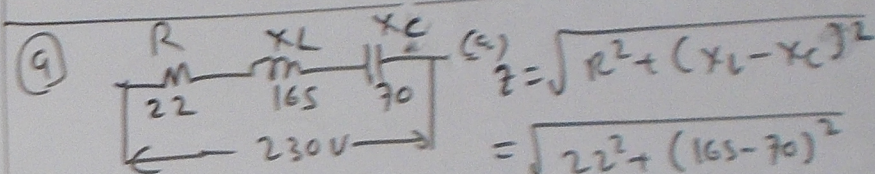
$$2\pi fL = 50 \rightarrow L = \frac{50}{2\pi f} = \frac{50}{2 \times 3.1416 \times 50} = 0.159 \text{ H}$$



$$Z = \frac{V}{I} = \frac{150}{3} = 50 \Omega$$

$$Z^2 = R^2 + X_L^2 \rightarrow X_L = \sqrt{Z^2 - R^2} = \sqrt{50^2 - 1^2} = 49.9 \Omega$$

$$L = \frac{X_L}{2\pi f} = \frac{49.9}{2 \times 3.1416 \times 50} = 0.159 \text{ H}$$



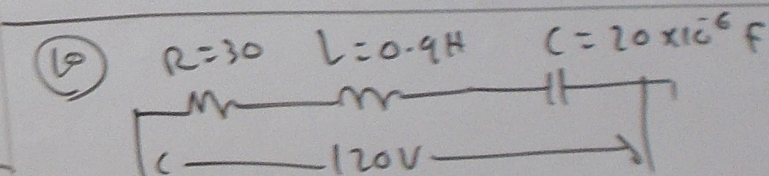
(a) $I = \frac{V}{Z} = \frac{230}{97.5} = 2.36 \text{ A} = 97.5 \Omega$

(c) $\theta = \tan^{-1} \frac{X_L - X_C}{R} = \tan^{-1} \frac{165 - 70}{22} = 77^\circ$

$$V_R = IR = 2.36 \times 22 = 51.9 \text{ V}$$

$$V_L = IX_L = 2.36 \times 165 = 389.4 \text{ V}$$

$$V_C = IX_C = 2.36 \times 70 = 165.2 \text{ V}$$



(a) $f_0 = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2 \times 3.1416 \sqrt{0.9 \times 20 \times 10^{-6}}} = 37.5 \text{ Hz}$

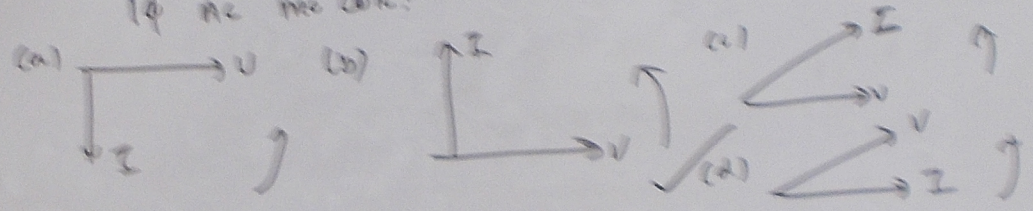
(b) $Z = R$ AT RESONANT $\rightarrow I = \frac{V}{R} = \frac{120}{30} = 4 \text{ A}$

(c) $V_C = IX_C = 4 \times \frac{1}{2\pi fC} = 4 \times \frac{1}{2 \times 3.1416 \times 37.5 \times 20 \times 10^{-6}} = 848.8 \text{ V}$



① A ROTARY GENERATOR IS TO BE RUN AT 1500 RPM TO GENERATE A 50 HZ FREQUENCY OUTPUT HOW MANY POLES SHOULD THERE BE?

② WHICH ONE OF FOLLOWING PHASOR DIAGRAM BELOW REPRESENTS THE RUNNING VOLTAGE AND CURRENT OF 1 ϕ AC MOTOR?



③ WHAT IS PEAK VALUE OF 280 Vrms AC VOLTAGE?

④ WHAT IS THE PERIOD OF 50 HZ SUPPLY?

⑤ ONE REASON WHY POWER FACTOR CORRECTION (OR) IMPROVEMENT IS DESIRABLE

⑥ SKETCH THE VECTOR DIAGRAM THAT INCLUDE E_{am} E_{bm} E_{cm} E_{ab} E_{bc} E_{ca}

⑦ IF A Δ MOTOR IS FOUND TO BE THE WRONG DIRECTION, HOW

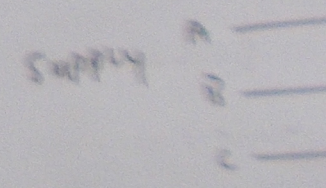
⑧ MULTIPLE EARTH NEUTRAL

⑨ LIST ONE SOURCE OF VOLTAGE IN POWER SYSTEM.

⑩ LINE TO LINE VOLTAGE OF 3 ϕ SYSTEM WHAT IS THE VOLTAGE BETWEEN PHASE AND NEUTRAL

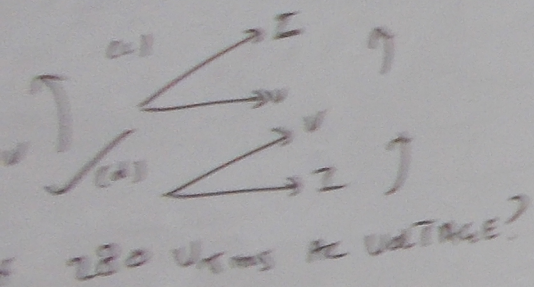
⑪ THE ELECTRICAL DEGREE OF A CYCLE HOW MANY PERIODS?

⑫ AN AC Δ TRANSFORMER MARKED AS SHOWN



to be run at 1500 RPM
output
of 30?

PHASOR DIAGRAM BELOW
VOLTAGE AND CURRENT OF



same supply?

the factor correction (or)

DIAGRAM

ACRAM THAT INCLUDE

to E_{ac} E_{cc}

⑦ IF A 3 ϕ MOTOR IS FOUND TO BE ROTATING IN THE WRONG DIRECTION, HOW IS THIS CORRECTED?

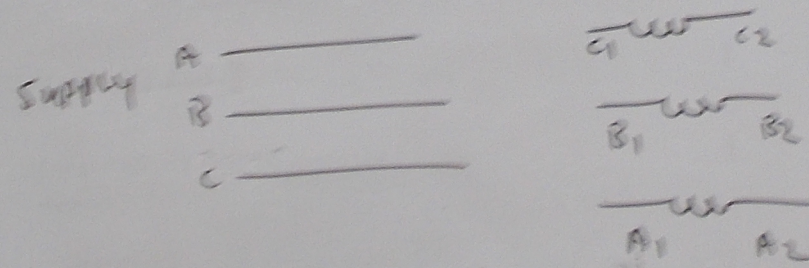
⑧ MULTIPLE EARTH NEUTRAL MEANS _____

⑨ LIST ONE SOURCE OF HARMONICS IN A SOME POWER SYSTEM.

⑩ LINE TO LINE VOLTAGE OF 3 ϕ SUPPLY IS 415V AC. WHAT IS THE VOLTAGE MAGNITUDE BETWEEN PHASE AND NEUTRAL?

⑪ π ELECTRICAL DEGREE IS EQUIVALENT TO HOW MANY PERIODS?

⑫ AN AC 3 ϕ TRANSFORMER HAS THE TERMINALS MARKED AS SHOWN BELOW. SHOW STAR CONNECTION



$$① N = \frac{120f}{P}$$

$$P = \frac{120f}{N} = \frac{120 \times 50}{1500} = 4$$

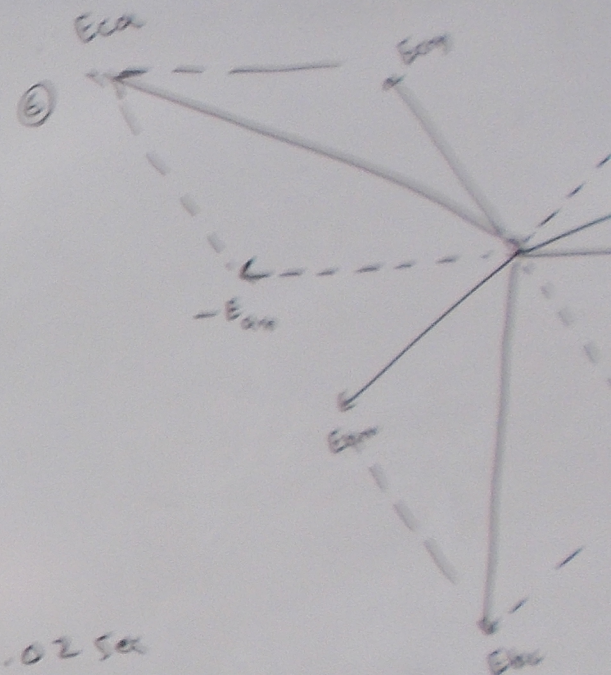
②

$$③ V_p = \sqrt{2} \times V_{rms} = 1.414 \times 280 = 400V$$

$$④ T = \frac{1}{f} = \frac{1}{50} = 0.02 \text{ sec} = 20 \text{ ms}$$

⑤ TO REDUCE LINE CURRENT AND POWER LOSS

⑥



⑦ TRANSPOSE

⑧ THE SUBSTA

⑨ TRANSFORM

$$⑩ U_{ph} = \frac{V_{line}}{\sqrt{3}}$$

$$⑪ 2\pi \rightarrow 1$$



OPEN SANDALS
AND
CANVAS SHOES
ARE NOT
APPROPRIATE
FOOTWEAR
IN THIS BUILDING

$$① N = \frac{120f}{P}$$

$$P = \frac{120f}{N} = \frac{120 \times 50}{1500} = 4$$

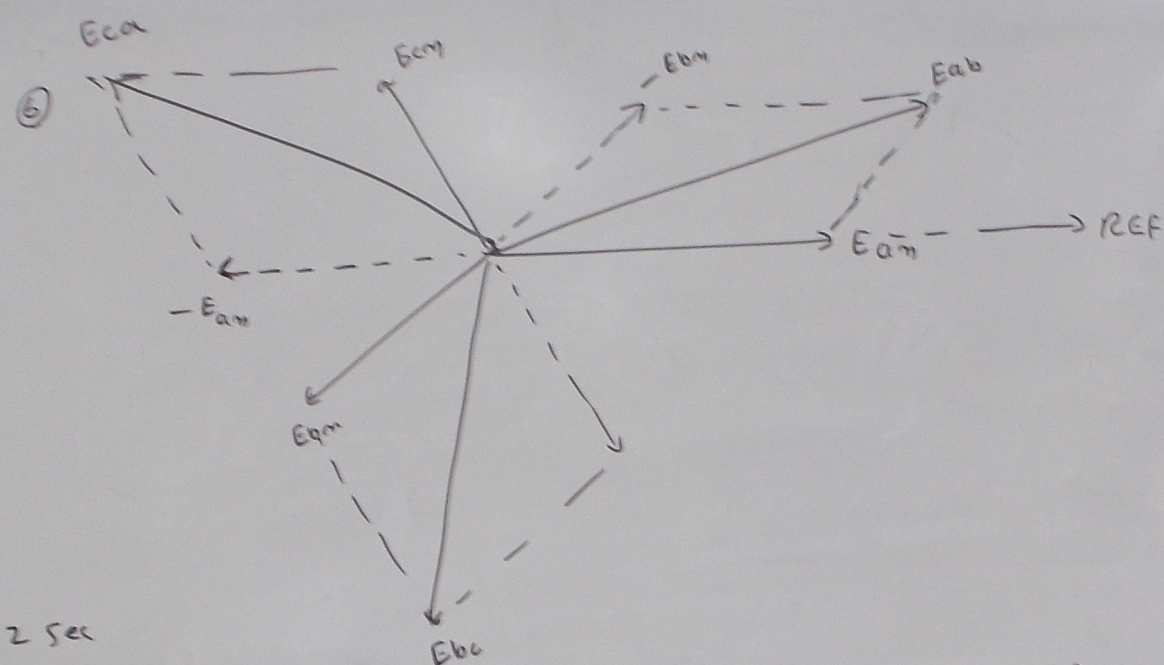
②

$$③ V_p = \sqrt{2} \times V_{rms} \\ = 1.414 \times 280 \\ = 400V$$

$$④ T = \frac{1}{f} = \frac{1}{50} = 0.02 \text{ sec} \\ = 20 \text{ ms}$$

⑤ TO REDUCE LINE CURRENT
AND POWER LOSS

⑥



⑦ TRANSPOSE ANY TWO OF MOTOR SUPPLY CABLE

⑧ THE SUBSTATION HAS MULTIPLE NEUTRALS EARTHED

⑨ TRANSFORMER / ELECTRONICS SWITCHING DEVICES

$$⑩ U_{ph} = \frac{V_{LINE}}{\sqrt{3}} = \frac{415}{\sqrt{3}} = 240V$$

$$⑪ 2\pi \rightarrow 1 \text{ PERIOD} \\ \pi \rightarrow \frac{1 \times \pi}{2\pi} = \frac{1}{2} \text{ PERIOD}$$

⑫

