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POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION

(MINISTRY OF HIGHER EDUCATION)

ELECTRICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION

JUNE 2012 SESSION

ET201 : ELECTRICAL CIRCUITS

DATE : 21 NOVEMBER 2012 (WEDNESDAY)

DURATION : 2 HOURS (11.15 AM – 1.15PM)

This paper consists of **THIRTEEN (13)** pages including the front page.
Section A1: Objective (10 questions – answer all)
Section A2 : Fill-in-the-blank (10 questions – answer all)
Section B : Structured (10 questions – answer all)
Section C : Essay (2 questions – answer all)

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(The CLO stated is for reference only)

3. When multiplying complex numbers in polar form,: [CLO1:C1]

   A. Multiply the angles and add the magnitudes

   B. Multiply both magnitudes and phase angle

   C. Multiply the magnitudes and subtract the phase angles

   D. Multiply the magnitudes and add the phase angles

4. In a certain RLC series circuit, $V_C = 7.26$ V, $V_L = 3.03$ V and $V_R = 9.08$ V. The value of the source voltage is [CLO2:C3]

   A. 10 V

   B. 20 V

   C. 30V

   D. 40 V

5. In a RC circuit, the voltage across the resistance is. [CLO1:C1]

   A. in phase with the source voltage

   B. in phase with the current

   C. lagging the source voltage by 90^0

   D. lagging the current by 90^0

6. If the resistance in parallel with a parallel resonant circuit is reduced, the bandwidth _____. [CLO1:C1]

   A. disappears

   B. decreases

   C. becomes sharper

   D. increases

7. When the frequency of an AC circuit containing resistance and inductance is increased, the current _____. [CLO1:C3]

   A. decreases

   B. increases

   C. stays the same

   D. none of the above

8. Choose the advantages of a three-phase system over a single-phase systems below: [CLO1:C2]

   i. In a balanced three-phase system, the conductors need only about 75% of the size of conductors for a single-phase two-wire system of the same power (KVA) rating.

   ii. The efficiency and power factor of three-phase motors are much better than single-phase motors for the same power transferred.

   iii. Three-phase motors have the ability to "self-start"; caused by the phase difference between three-phase coils, but not in single-phase motors.

   iv. Three-phase transformers are lighter, cheaper and more efficient compared to a single phase transformer of the same size.

A. i and ii

B. i, ii, and iii

C. ii, iii, and iv

D. i, ii, iii, and iv

9. By referring to Figure A1 (9), if the supply voltage is 240 V, calculate the current flow to load. [CLO2:C3]

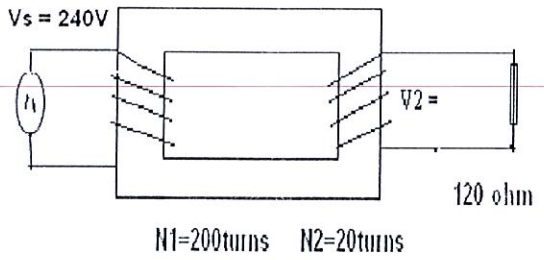

Figure A1(9)

A. 0.02 amp

B. 0.2 amp

C. 2 amp

D. 20 amp

10. The turns ratio of a certain transformer is 10 and the primary AC voltage is 6V. Find the secondary voltage. [CLO1:C3]

A. 60V

B. 6V

C. 0.6V

D. 36V

SECTION A2

FILL-IN-THE-BLANK QUESTIONS (10 marks)

INSTRUCTION:

This section consists of **TEN (10)** fill-in-the-blank questions. Answer **ALL** questions in the answer booklet.

For question 1, 2 and 3 refer to Figure A2 (1-3)

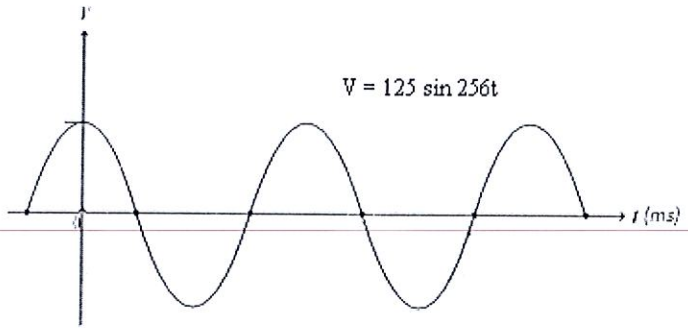

Figure A2 (1-3)

QUESTION 1

The frequency of the waveform is_____.[CLO2:C3]

QUESTION 2

The average voltage of the waveform is_____.[CLO2:C3]

QUESTION 3

The root mean square voltage of the waveform is_____.[CLO2:C3]

QUESTION 4

Express the complex number $z = -1 + 3j$ in polar form. [CLO2:C2]

QUESTION 5

Based on the circuit in Figure A2 (5), find the total Impedance for R-L circuit. [CLO2:C3]

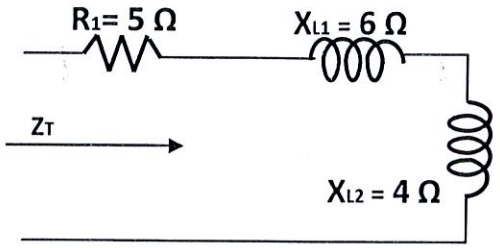

Figure A2 (5)

QUESTION 6

Find the Power Factor of the Power Triangle in Figure A2 (6). [CLO2:C3]

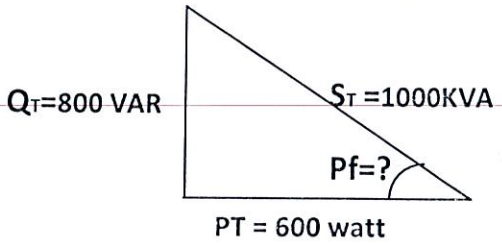

Figure A2(6)

QUESTION 7

If the existing coil is replaced with one having a lower value of Q, the bandwidth will _____[CLO1:C1]

QUESTION 8

The formula for total true power in a balanced three phase load is _____. [CLO1:C2]

QUESTION 9

Three 100 Ω resistor is connected in star with 415V three phase line. What is the line current? [CLO2:C3]

QUESTION10

The percentage of the input power that is delivered to the output power of a transformer is called _____. [CLO1:C1]

SECTION B

STRUCTURED QUESTIONS (30 marks)

INSTRUCTION:

This section consists of **TEN (10)** structured questions. Answer **ALL** questions.

QUESTION 1

List two methods of generating alternating current. [CLO1:C1]

(3 marks)

QUESTION 2

Two sinusoidal voltages are [CLO2:C3]

$$v_1 = 10\sin 314t$$

$$v_2 = 10\sin(314t+\pi/4)$$

a. Add these two voltages

b. Determine the RMS value

(4 marks)

QUESTION 3

Convert the angle of 5.32 radian to degree unit. [CLO2:C2]

(2 marks)

QUESTION 4

Describe the characteristics of purely capacitive circuit with the aid of a correct waveform and phasor diagram.[CLO1:C2]

(3 marks)

QUESTION 5

A capacitor of 10 mF is connected in series with a 200 Ω resistor to a 240 V, 50 Hz supply. Calculate the total impedance of the circuit.[CLO2:C3]

(3 marks)

QUESTION 6

A 120Ω resistor is in parallel with a capacitor with a capacitive reactance of 40Ω. Both components are across a 12 V ac source. What is the magnitude of the total impedance? [CLO2:C3]

(3 marks)

QUESTION 7

If the lower critical frequency is 2400 Hz and upper critical frequency is 2800 Hz. Find the bandwidth and frequency resonant. [CLO2:C3]

(3 marks)

QUESTION 8

A balanced three-phase load is star-connected and has an impedance of $Z = 4\text{-}j3\Omega$ in each phase. Find the line current if it is connected across a 220 V supply. [CLO2:C3]

(3 marks)

QUESTION 9

In the balance star connection power system. Calculate the phase voltage (V_{PH}) if the line voltage (V_L) equals to 480V.
[CLO2:C3]

(3 marks)

QUESTION 10

List **THREE (3)** types of transformer losses. [CLO1:C1]

(3 marks)

SECTION C

ESSAY QUESTIONS (50 marks)

INSTRUCTION:

This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

QUESTION 1

(a) By referring to Figure C1(a): [CLO2:C3]

i. Determine the value of each current

(4 marks)

ii. Describe each phase relationship with the source voltage.

(2 marks)

iii. Draw the current phasor diagram, current and voltage waveform.

(3 marks)

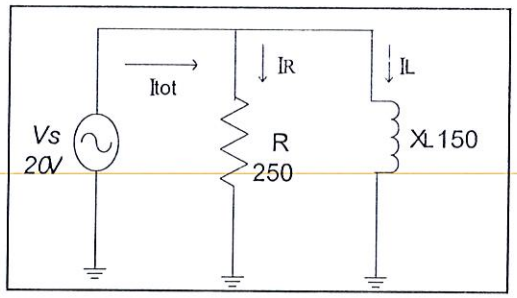

Figure C1(a)

QUESTION 10

List **THREE (3)** types of transformer losses. [CLO1:C1]

(3 marks)

SECTION C

ESSAY QUESTIONS (50 marks)

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This section consists of **TWO (2)** essay questions. Answer **ALL** questions.

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(3 marks)

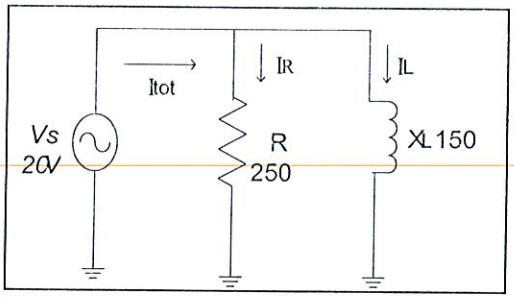

Figure C1(a)

QUESTION 2

a) i) Draw and label the circuit diagram for star connection. [CLO1:C1]

(5 marks)

ii) Three balanced load connected in star to a three phase supply using a total power of 5 kW, 415 V, 50 Hz and take a line current of 12 A. Calculate the load power factor, impedance of each load and apparent power. [CLO2:C3]

(10 marks)

b) In the Figure C (2b) below, if each primary voltage can accommodate 120V AC: [CLO2:C3]

i. Show how the primaries should be connected to a 240V AC operation by using appropriate diagram.

(2 marks)

ii. Determine each secondary voltage for 240V operation.

(8 marks)

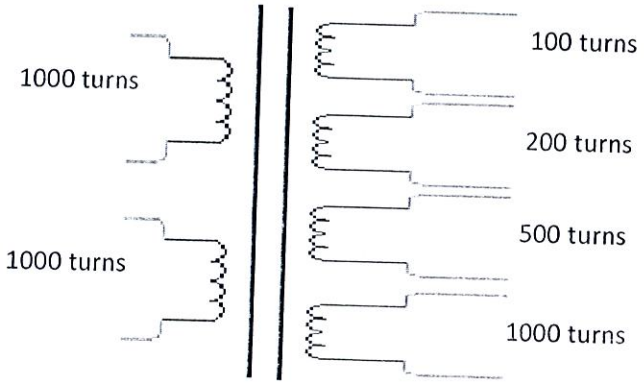

Figure C2(b)