UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(ONLINE)
SEMESTER II
SESSION 2020/2021

COURSE NAME	:	POWER SYSTEM
COURSE CODE	:	BEJ20603
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	1) ANSWER **ALL** QUESTIONS 2) **OPEN BOOK EXAMINATION** 3) PLEASE SUBMIT THE ANSWER BOOKLET AND THE DECLARATION FORM WITHIN 15 MINUTES AFTER THE EXAMINATION ENDS 4) SUBMIT ALL OF THE DOCUMENS IN PDF FILES

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

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Q1 (a) Based on the circuit in **Figure Q1(a)**:

(i) Calculate the current, the true power, the reactive power and the apparent power for the load.

(5 marks)

(ii) Determine the power factor of the circuit.

(2 marks)

(b) With the help of appropriate diagram, differentiate between the lagging power factor and leading power factor.

(4 marks)

(c) An AC generator whose emf is given by $v(t) = 4\sin(1 \times 10^4)t\ (V)$, is connected to an RLC circuit for which $L = 2\ mH$, $C = 4\ \mu F$, and $R = 5\ \Omega$.

(i) Determine the r.m.s. voltage across the generator.

(1 mark)

(ii) Calculate the impedance of the circuit.

(3 marks)

(iii) Sketch the impedance triangle of the circuit.

(2 marks)

(iv) Calculate the average power transmitted to the circuit.

(4 marks)

(d) Differentiate between the instantaneous power and the average power. Write the appropriate formula that articulate the instantaneous power and the average power respectively.

(4 marks)

Q2 (a) A three-phase load of identical impedances, that can be Y-connected or Δ-connected, is composed of two 200 Ω resistors in parallel connection. Determine which connection will absorb lesser average power from the three-phase source with a line voltage of 400 V. Assume zero line impedance.

(12 marks)

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(b) In a balanced three-phase Δ-Y circuit, the source is connected in negative sequence with $V_{bc} = 120 \angle 20°$ V. The line impedance, Z_L is $2 + j1\ \Omega$ whilst the load impedance, Z_Y is $18 + j14\ \Omega$ respectively. Calculate the line currents.

(4 marks)

(c) Three identical Y-connected loads, each having a resistance of 20 Ω in parallel with an inductor, are connected to a three phase supply of 400 V and 50 Hz frequency. The power absorb by the load is 8 kW and power factor at the load is 0.9919.

(i) Determine the current that flows through the inductor. Please state the assumptions used to solve the question.

(7 marks)

(ii) Calculate load inductance in Henry (H).

(2 marks)

Q3 (a) A three-phase transmission line has a per phase impedance of 1 Ω resistor that is in series connection with 3 Ω inductor. The line feeds a balanced Δ-connected load, with a total reactive power of 5 kVAR and power factor angle of 22.62°. If the line voltage across the load terminal has a magnitude of 240 V :

(i) Calculate the magnitude of the line voltage and the phase voltage at the source end.

(8 marks)

(ii) Determine the complex power of the source.

(2 marks)

(iii) Calculate the source power factor.

(2 marks)

(b) A balanced three-phase Y-connected generator with $V_{bc} = 440 \angle 20°$ V supplies an unbalanced Δ-connected load with $Z_{AB} = -j5\ \Omega$, $Z_{BC} = j10\ \Omega$ and $Z_{CA} - 20\ \Omega$.

(i) Determine the line currents.

(9 marks)

(ii) Calculate the total complex power supplied by the source.

(4 marks)

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Q4 (a) Describe the formula to calculate a power factor of a non-linear load.
(5 marks)

(b) State **THREE (3)** example of loads that will caused low power factor in an industry.
(3 marks)

(c) A 230 V, 50 Hz power source is connected to the some loads, where:

- Load-1: R = 4.5 Ω and in series connection with L = 8 mH.
- Load-2: 10 kVA of power factor 0.6 lagging.
- Load-3: 5 kVAR of power factor 0.5 lagging.

(i) Determine the active power and reactive power of the Load-1.
(5 marks)

(ii) Determine the total current delivers by the supply and the total power factor.
(8 marks)

(iii) Calculate the required capacitor in order to increase the power factor to unity.
(4 marks)

– END OF QUESTIONS–

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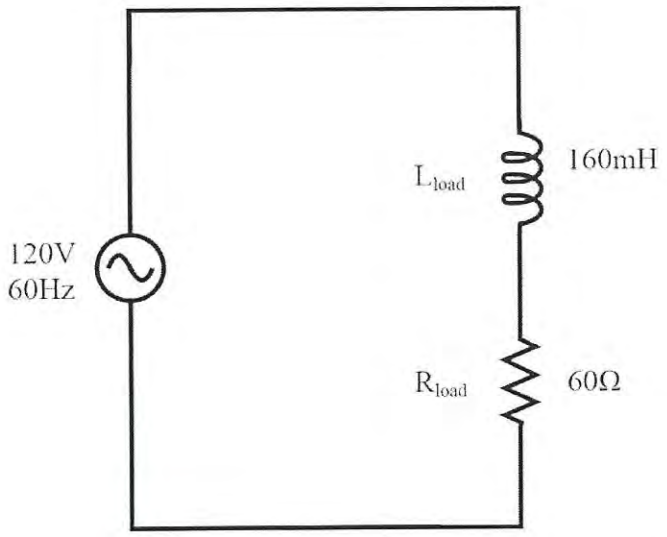

Figure Q1(a)

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