



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017**

COURSE : ELECTRICAL POWER
TRANSMISSION AND
DISTRIBUTION

COURSE CODE : BEF 34603

PROGRAMME CODE : BEV

EXAMINATION DATE : JUNE 2017

DURATION : 3 HOURS

INSTRUCTION : ANSWER ALL QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1 (a) Overhead and underground systems are the systems used in electric power transmission and distribution.

(i) Discuss **two (2)** advantages of overhead system over underground system. (2 marks)

(ii) List **three (3)** connection schemes for electric power distribution system. (3 marks)

(b) A 50 Hz, 220 kV three-phase three-wire overhead line has solid cylindrical conductors arranged in the form of an equilateral triangle with 1.2 m conductor spacing. The conductor diameter is 1.5 cm.

(i) Calculate the inductance per km and the capacitance to neutral per km of the conductor. (6 marks)

(ii) If the diameter of each conductor is increased to 5 cm without changing the conductor spacing, calculate the new capacitance to neutral per km of the conductors. (3 marks)

(iii) Calculate the charging current per phase, I_c , for each conductor's condition in **Q1(b)(i)** and **Q1(b)(ii)**. (4 marks)

(iv) Discuss the result obtained in **Q1(b)(i)**, **Q1(b)(ii)** and **Q1(b)(iii)**. (2 marks)

Q2 (a) Draw and label the nominal π model of a 300 km length transmission line. (2 marks)

(b) A three-phase, 50 Hz, completely transposed 200 km line has two 795,000-cmil 26/2 ACSR conductors per bundle and the following positive-sequence line constants:

$$\begin{aligned} \text{Resistance/phase/km} &= 0.1 \, \Omega \\ \text{Reactance/phase/km} &= 0.5 \, \Omega \\ \text{Susceptance/phase/km} &= j10^{-5} \, \text{S} \end{aligned}$$

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The full load condition at the receiving end of the line is 20 MW at 0.8 p.f. lagging and at 66 kV. Assuming the nominal π line model,

(i) Determine the sending end voltage and voltage regulation of the line. (11 marks)

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(ii) Determine the transmission line efficiency at full load. (3 marks)

(iii) Compare and explain the voltage regulation of the transmission line with the results in **Q2(b)(i)** if the transmission line delivers 20 MVA and at unity power factor to the load. (4 marks)

Q3 (a) Static capacitor is one of the widely used power factor equipment in electric power systems.

(i) Briefly explain how the static capacitor improves power factor at the load side. (2 marks)

(ii) List down **two (2)** disadvantages of using static capacitor to improve the power factor. (2 marks)

(b) A single phase motor connected to 400 V, 50 Hz supply takes 42.2 A at power factor of 0.72 lagging.

(i) Sketch the circuit and phasor diagram with appropriate labels when the capacitance is connected in parallel with the motor in order to increase the power factor. (4 marks)

(ii) Propose the capacitance require to raise the power factor to 0.90 lagging. (10 marks)

(c) Compare the relationship of power factor with the voltage regulation of the motor if the power factor is less than 0.85 lagging. (2 marks)

Q4 (a) With appropriate diagram, briefly explain the **three (3)** primary distribution lines circuits. (6 marks)

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(b) A single phase distributor **one** km long has resistance and reactance per conductor of 0.1 and 0.15 ohm respectively. At the far end, the voltage $V_B = 200$ V and the current is 100 A at p.f. of 0.8 lagging. At mid-point M of the distributor, a current of 100 A is tapped at p.f. of 0.6 lagging with reference to the voltage V_M at the mid-point.

(i) Calculate the voltage at mid-point.

(5 marks)

(ii) Calculate the sending end voltage.

(6 marks)

(iii) Calculate the phase angle between V_A and V_B .

(3 marks)

Q5 (a) Oil-filled cables can be divided into three types which are single-core conductor channel, single-core sheath channel and three-core filler-space channels. Draw the structure of these three types of cable with appropriate label.

(6 marks)

(b) The maximum and minimum stresses in the dielectric of a single core cable are 40 kV/cm(rms) and 10 kV/cm(rms) respectively. If the conductor diameter is 3cm:

(i) Calculate the thickness of the insulation.

(6 marks)

(ii) Calculate the operating voltage.

(5 marks)

(c) The reliability of underground cable network depends to the proper laying and attachment fitting. Recommend **three (3)** main methods of laying underground cables.

(3 marks)

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- END OF QUESTION -