Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	POWER GENERATION, TRANSMISSION AND DISTRIBUTION
COURSE CODE	:	BEF 36003
PROGRAMME CODE	:	BEV
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

Q1 (a) Explain **TWO (2)** important desirable properties which the insulators should have and list **TWO (2)** types of insulators that are commonly used.

(6 marks)

(b) The towers of height 30 m and 70 m, respectively support a transmission line conductor at water crossing. Base of the towers can be considered to be at water level. The horizontal distance between the towers is 400 m and weight of conductor is 1.5 kg/m. If the tension in the conductor is 1500 kg, analyse:

(i) The minimum clearance of the conductor and water.

(10 marks)

(i) The clearance mid-way between the supports.

(4 marks)

(c) A 220 kV, 50 Hz, 200 km long 3-phase line has its conductors at the corners of a triangle with sides 6 m, 6 m and 12 m. The conductor radius is 1.81 cm. Determine:

(i) The capacitance per phase per km.

(3 marks)

(ii) The capacitive reactance per phase.

(1 mark)

(iii) The charging current.

(1 mark)

Q2 (a) List **THREE (3)** transmission voltage levels in Malaysia.

(3 marks)

(b) Compare the short and medium transmission lines in terms of the range of length and the model.

(6 marks)

(c) A 220 kV, 200 MVA and 50 Hz, three-phase transmission line completely transposed for a length of 150 km has the following positive-sequence impedance and admittance:

$r = 0.11\ \Omega/km$
$x = 0.90\ \Omega/km$
$y = 5.0 \times 10^{-6}\ S/km$

The voltage at the receiving end of the transmission line is 200 kV, determine:

(i) The values of series impedance and shunt admittance of the transmission line.

(2 marks)

(ii) The value of sending end voltage if the line supplying rated voltage and rated apparent power at p.f. of 0.85 lagging.

(8 marks)

(iii) The voltage regulation of the transmission line.

(2 marks)

(iv) The efficiency of the transmission line when it is supplying rated apparent power at p.f. of 0.85 lagging.

(4 marks)

Q3 (a) Define power factor and describe the characteristic of current-voltage in capacitive circuit. Include the respective power triangle diagram and labels.

(5 marks)

(b) A water pump (single phase motor) connected to 400 V, 50 Hz supply takes 35.8 A at a power factor of 0.75 lagging.

(i) Propose one simple approach to increase the power factor.

(2 marks)

(ii) Sketch a simple circuit representation and the respective phasor diagram for the answer in **Q3(b)(i)**.

(4 marks)

(iii) Determine the required capacitance in order to increase the power factor up to 0.95 lagging.

(8 marks)

(c) Highlight and discuss **THREE (3)** importance of power factor improvement to the consumers and power generating stations.

(6 marks)

Q4 (a) Describe **THREE (3)** general roles of distribution substation in power distribution network.

(3 marks)

(b) Explain **THREE (3)** types of primary distribution lines circuits. Include appropriate illustration for the respective type.

(6 marks)

(c) A 1000 m long, single phase distributor as shown in **Figure Q4(c)**, has resistance and reactance per conductor of 0.1 and 0.15 ohm respectively. At the far end point B, 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. Analyse:

(i) The voltage at mid-point.

(7 marks)

(ii) The sending end voltage.

(6 marks)

(iii) The phase angle between V_A and V_B.

(3 marks)

END OF QUESTIONS –

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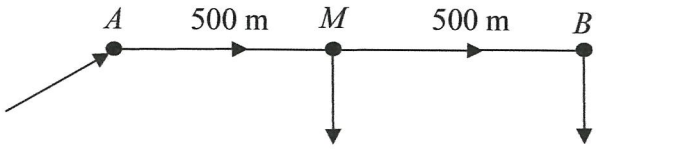

$I_M = 100$ A
$\cos \theta_M = 0.6$ lag

$I_B = 100$ A
$\cos \theta_B = 0.8$ lag

Figure Q4(c)