Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE	:	ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION
COURSE CODE	:	BEF 34603
PROGRAMME CODE	:	BEV
EXAMINATION DATE	:	JUNE/JULY 2016
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

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

CONFIDENTIAL

Q1 (a) A 50 km long transmission line supplies a load of 5 MVA at 0.8 p.f lagging at 33 kV. The efficiency of transmission is 90% and the specific resistance of aluminium is 2.85 x 10^{-8} Ωm. Determine the volume of aluminium conductor required for the line when:

(i) single phase, 2-wire system is used

(8 marks)

(ii) three phase, 3-wire system is used

(5 marks)

(b) Recommend the best system that can be used with justification from the result in **Q1(a)(i)** and **Q1(a)(ii)**.

(4 marks)

(c) Investigate the relationship between temperature, tension and sag.

(3 marks)

Q2 (a) An insulator string for 66 kV line has 4 discs. The shunt capacitance between each joint and metal work is 10% of the capacitance of each disc.

(i) Determine the voltage across the different discs.

(8 marks)

(ii) Determine the string efficiency.

(2 marks)

(b) Skin effect is caused by magnetic flux set up due to alternating current inside the conductor. Discuss the skin effect phenomenon in d.c system.

(4 marks)

(c) A 3-phase, 50 Hz, 275 kV overhead line has conductors placed as shown in **Figure Q2(c)**. Conductor diameter is 3 cm. Assume the line length is 150 km and neglect the effect of ground.

(i) Determine the line to neutral capacitance per km.

(4 marks)

(ii) Determine the charging current per phase per km when the line is completely transposed.

(2 marks)

Q3 (a) Draw and label the equivalent circuit of a medium length line for nominal π model.

(2 marks)

(b) A 220 kV, 200 MVA and 50 Hz, three-phase transmission line is 150 km long completely transposed transmission line has the following positive-sequence impedance and admittance:

$r = 16.5\ \Omega$
$x = 0.90\ \Omega/km$
$y = 5.0 \times 10^{-6}\ S/km$

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

(i) Calculate the value of sending end voltage if the line supplying rated voltage and rated apparent power at 0.85 PF lagging.

(7 marks)

(ii) Calculate the efficiency of the transmission line.

(4 marks)

(iii) Compare and explain the efficiency of the transmission line with the results in **Q3(b)(ii)** if the transmission line supplies change to 200 MVA load at unity power factor.

(7 marks)

Q4 (a) Power factor of an AC electrical power system is defined as the ratio between the load's real power to the apparent power in the circuit. Briefly explain **three (3)** causes of low power factor.

(6 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.

(8 marks)

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

(2 marks)

Q5 (a) Construct and explain briefly the **three (3)** primary distribution lines circuits.

(6 marks)

(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 $V_B = 200V$ and the current is 100A 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.

(4 marks)

(ii) Calculate the sending end voltage.

(5 marks)

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

(2 marks)

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

(3 marks)

- END OF QUESTION –

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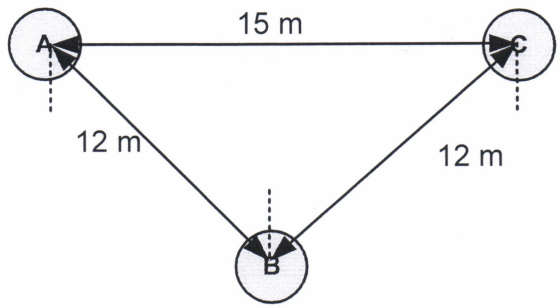

FIGURE Q2(C)