Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION SYSTEM
COURSE CODE	:	BEF 34603
PROGRAMME	:	BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE 2015 / JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 (a) Corona is the phenomena of violet glow, hissing noise and production of ozone gas in an overhead transmission line. Explain **three (3)** factors affecting corona.

(6 marks)

(b) The towers of height 30 m and 70 m respectively support a transmission line conductor at water crossing. Bases 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:

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

(10 marks)

(ii) Calculate the clearance mid-way between the supports.

(4 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. Find the voltage across the different discs and string efficiency.

(10 marks)

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

(2 marks)

(c) A three-phase, 50 Hz, 132 kV overhead line has conductors placed as shown in **Figure Q2(c)**. Conductor diameter is 3 cm and the line length is 120 km. Assume the line is completely transposed and neglecting the effect of ground.

(i) Determine the capacitance of the transmission line per phase.

(6 marks)

(ii) Determine the reactive power from charging the capacitance.

(2 marks

Q3 (a) **Figure Q3(a)** shows the equivalent circuit of a medium length line for nominal π model which the total series impedance, $Z = R + jX$ and shunt admittance, $\frac{Y}{2}$. Show the constant ABCD for the nominal π model is:

$$A = D = \left(1 + \frac{ZY}{2}\right) \qquad B = Z \qquad C = Y\left(1 + \frac{ZY}{4}\right)$$

(5 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 = 0.11 Ω/km
x = 0.90 Ω/km
y = 5.0 X 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 0.85 PF lagging.

(8 marks)

(iii) The value of voltage regulation of the transmission line.

(1 mark)

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

(4 marks)

Q4 (a) Briefly explain **two (2)** effects of low power factor in power supply system.

(4 marks)

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

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

(2 marks)

(ii) Propose the capacitance required to raise the power factor to 0.95 lagging.

(8 marks)

(c) A 2 km long single phase distributor supplies a load of 120 A at 0.8 p.f. lagging at its far end and a load of 80 A at 0.9 p.f. lagging at its mid-point. Both power factor are referred to the voltage at the far end. The resistance and reactance per km are 0.05 Ω and 0.1 Ω respectively. If the voltage at the far end is maintain at 230 V, by sketching the single line diagram for the distributor AB with C as the mid-point, analyze:

i) Voltage at the sending end.

(5 marks)

ii) Phase angle between voltage at the two ends.

(1 mark)

Q5 (a) Classify **four (4)** types of underground cables according to the voltage for which they are manufactured.

(4 marks)

(b) A 11 kV, 50 Hz, single phase underground cable is 3.5 km long, has a conductor diameter of 20 mm and internal sheath radius of 15 mm. If the specific resistance of insulation is 5×10^{14} Ω-cm and the relative permittivity of insulation is 2.4, determine:

(i) The insulation resistance.

(2 marks)

(ii) Capacitance of the cable per phase.

(2 marks)

(iii) Charging current per phase.

(2 marks)

(iv) Total charging kVar.

(2 marks)

(c) A single core 66 kV cable working on three phase system has a conductor diameter of 2 cm and a sheath of inside diameter 5.3 cm. If two intersheaths are introduced in such a way that the stress varies between the same maximum and minimum in the three layers, evaluate:

(i) Positions of intersheaths.

(3 marks)

(ii) Voltage on the intersheaths.

(3 marks)

(iii) Maximum and minimum stress occurs in the cable.

(2 marks)

- END OF QUESTIONS -

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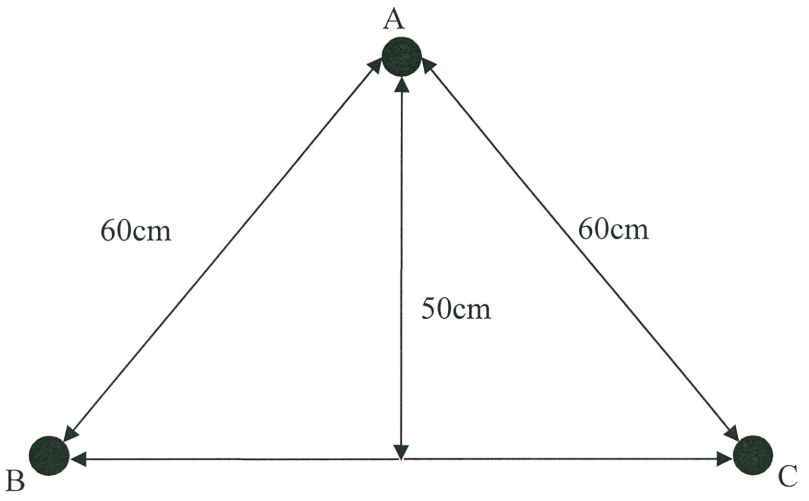

FIGURE Q2(c)

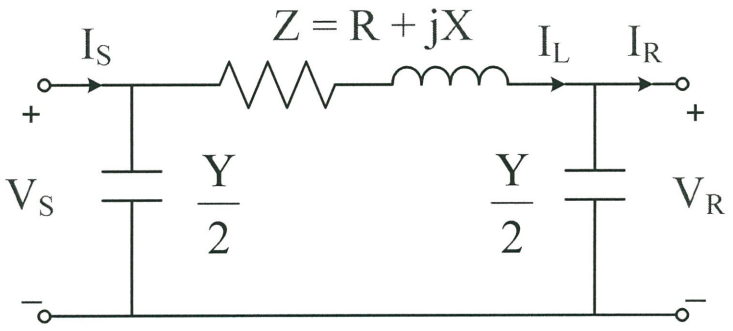

FIGURE Q3(a)