UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012

COURSE NAME	:	ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION SYSTEM
COURSE CODE	:	BEK 4213
PROGRAMME	:	BEE
EXAMINATION DATE	:	JUNE 2012
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS.

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

Q1 (a) The transmission of electric power is carried at high voltages due to a few reasons. Show the advantages of using high transmission voltage with the aid of appropriate equations.

(12 marks)

(b) A 3-phase, 275 kV, 50 Hz transmission line consists of 1·5 cm radius conductor spaced 2 metres apart in equilateral triangular formation. If the temperature is 40°C and atmospheric pressure is 76 cm, determine the corona loss per km of the line. Take $m_o = 0{\cdot}85$.

(7 marks)

(c) A transmission line has a span of 214 metres between level supports. The conductors have a cross-sectional area of 3·225 cm^2. Calculate the factor of safety under the following conditions :

Vertical sag = 2·35 m ; Wind pressure = 1·5 kg/m
Breaking stress = 2540 kg/cm2 ; Wt. of conductor = 1·125 kg/m

(6 marks)

Q2 (a) Construct the sketch of a single-core low tension cable, label the various parts and briefly explain the function of each part.

(7 marks)

(b) A 33 kV, 50 Hz, 3-phase underground cable, 4 km long uses three single core cables. Each of the conductor has a diameter of 2·5 cm and the radial thickness of insulation is 0·5 cm. The relative permittivity of insulation is 3. Analyze:

(i) Capacitance of the cable per phase
(ii) Charging current per phase
(iii) Total charging kVar

(6 marks)

(c) A single core cable for 33 kV 3-phase has a conductor of 2 cm diameter and sheath of inside diameter 5.3 cm. It is required to have two inter-sheaths so that stress varies between the same maximum and minimum values in the three layers of dielectric. Compose :

(i) The positions of inter-sheaths
(ii) The voltages on the inter-sheaths
(iii) Maximum and minimum stress
(iv) Maximum and minimum stress if the inter-sheaths are not used

(12 marks)

Q3 A 50 Hz transmission line 300 km long has a total series impedance of 40 + j125 ohms and a total shunt admittance of 10^{-3} mho. The receiving-end load is 50 MW at 275 kV with 0.8 lagging power factor. Deduce and predict the sending-end voltage, current, power and power factor using :

(i) Short line approximations
(ii) Normal-π method
(iii) Exact transmission line equation

Compare the results and comment.

(25 marks)

Q4 (a) There are three different ways in which the feeder can be laid. List two (2) different types of feeders and discuss their relative advantages and disadvantages.

(6 marks)

(b) A three phase ring network ABCD fed at A at 11 kV supplies balanced loads of 50 A at 0.8 power factor lagging at B, 120 A at unity power factor at C and 70 A at 0.866 power factor lagging at D, the load currents being referred to the supply voltage at A. The impedance of the various sections is shown in Figure Q4 (b). Evaluate the currents in various sections and station bus-bar voltages at B, C and D.

(1 9 marks)

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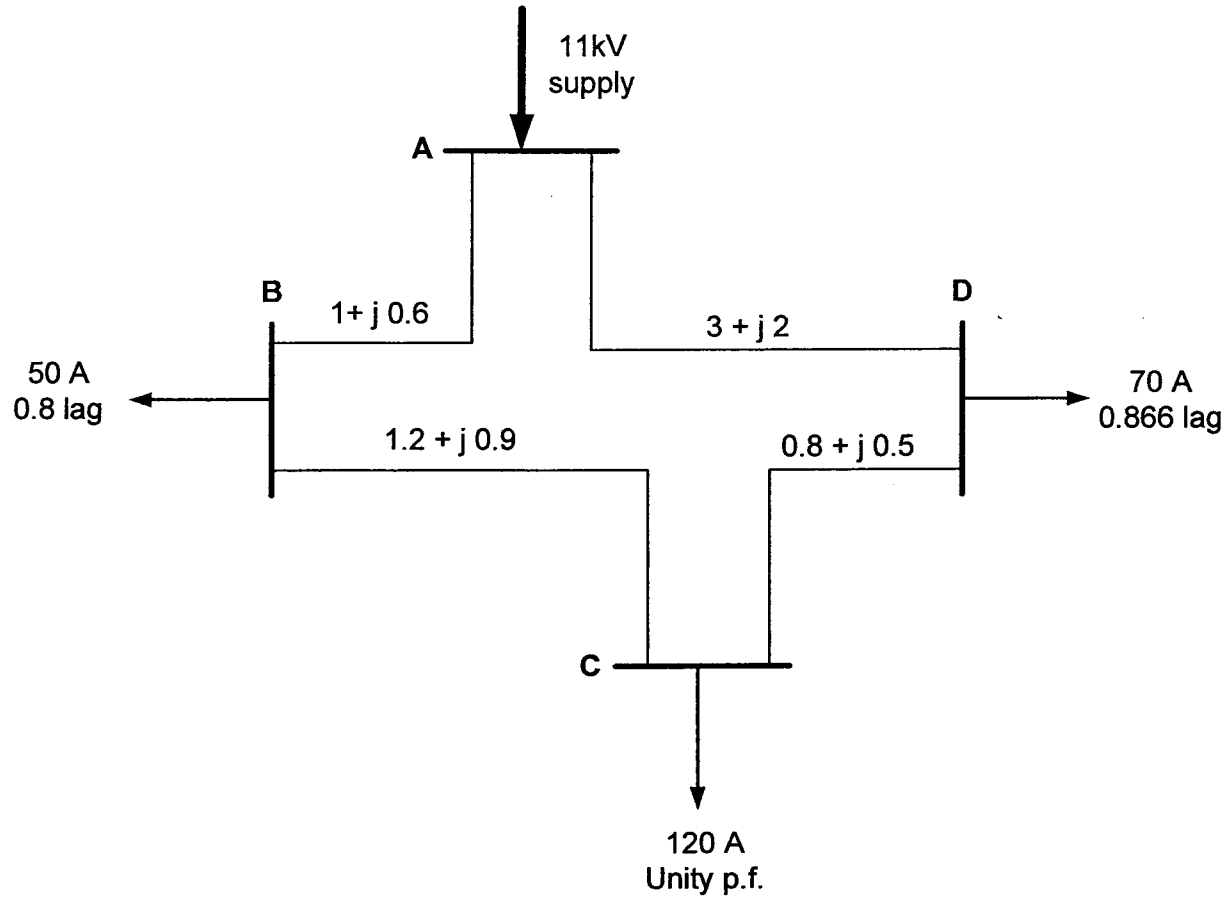

Figure Q4(b)

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The maximum potential gradient

$$Emax = \frac{V}{r \ln \frac{R}{r}}$$

Capacitance between core and sheath

$$C = \frac{2\pi\varepsilon_o\varepsilon_r}{ln\frac{R}{r}} \quad \text{F/m}$$

Capacitance of the line

$$C_{12} = \frac{\pi\varepsilon_o}{ln\frac{D}{r}} \quad F/m$$

$$C_n = \frac{2\pi\varepsilon_o}{ln\frac{D}{r}} \quad F/m$$

Medium Transmission Line Equation (π – network circuit)

$$V_S = AV_R + BI_R$$
$$I_S = CV_R + DI_R$$

where:

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

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Exact Transmission Line Equation

A = D = cosh γl
B = Zc sinh γl
C = ½ (sinh γl)
γ = α + jβ

$$\cosh(\alpha l + j\beta l) = \frac{1}{2}(e^{\alpha l} < \beta l + e^{-\alpha l} < -\beta l)$$

$$\sinh(\alpha l + j\beta l) = \frac{1}{2}(e^{\alpha l} < \beta l - e^{-\alpha l} < -\beta l)$$