higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

COMMUNICATION-ELECTRONICS N6

11 APRIL 2016

This marking guideline consists of 7 pages.

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QUESTION 1: ATTENUATOR AND FILTERS

1.1 1.1.1 m – derived T – section Low-pass Filter
m – derived π- section High-pass Filter (2)

1.1.2 A $= \frac{ML}{2}$, B $= \frac{ML}{2}$; C $= MC$; D $(\frac{1-m^2}{4m})$L

E $= \frac{2L}{m}$; F $= \frac{C}{m}$; G $(\frac{4m}{1-m^2})$L; H $= \frac{2L}{m}$ (8)

1.2 $L = \frac{R_O}{4\pi F_C}$

$= \frac{600}{4 \times 3{,}142 \times 7 \times 10^3}$

$= \xrightarrow{6{,}82\ mH}$

$C = \frac{1}{4\pi R_{OF_C}}$

$= \frac{1}{4 \times 3{,}142 \times 7 \times 10^3}$

$= \xrightarrow{18{,}945nF}$

$m = \sqrt{1 - \left(\frac{F_o}{F_c}\right)^2}$

$= \sqrt{1 - (\frac{5 \times 10^3}{7 \times 10^3})^2}$

$= \xrightarrow{0{,}7}$

Series L $= \left(\frac{4m}{1-m^2}\right)L$

$= \frac{4 \times 0{,}7}{1 - 0{,}7^2} \times 6{,}82\ 10^{-3}$

$= \xrightarrow{37{,}443\ mH}$

Series C $= \frac{C}{m}$

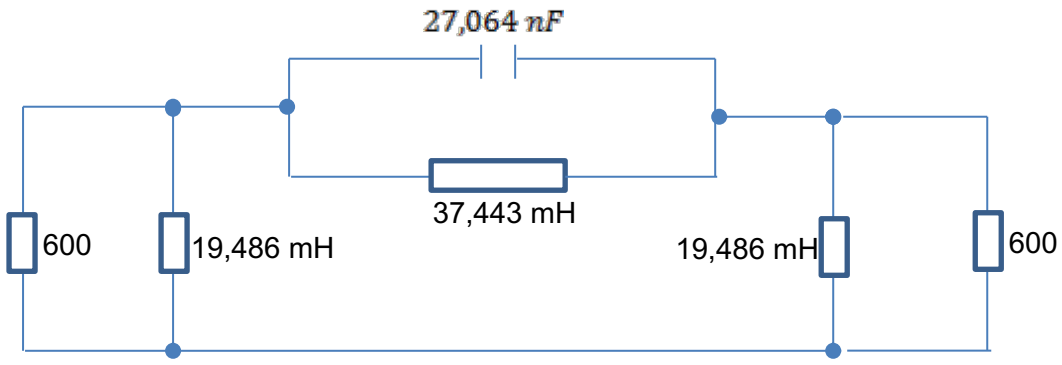
$= \frac{18{,}945 \times 10^{-9}}{0{,}7}$

$= 27{,}064\ nF \longrightarrow$

Shunt L $= \frac{2L}{M}$

$= \frac{2 \times 6{,}82 \times 10^{-3}}{0{,}7}$

$= 19{,}486\ mH \longrightarrow$

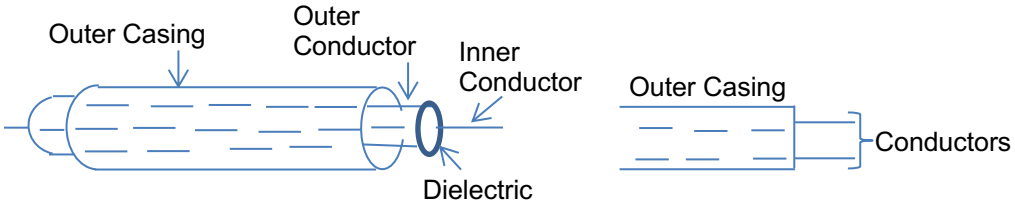


(15)
[25]

QUESTION 2: TRANSMISSION LINES

2.1 2.1.1 The parallel wire (balanced) line: is employed where balanced properties are required such as connecting a folded-dipole antenna to a TV receiver or rhombic antenna to an HF transmitter.

2.1.2 The coaxial (unbalanced) line: is used when unbalanced properties are needed such as in the inter connection of a broadcast transmitter to its grounded antenna and at UHF and microwave frequencies to avoid the risk of radiation from transmission itself.



(5 x 2) (10)

2.2
- Radiation
- Conductor heating
- Dielectric heating (3)

2.3 Stub-line matching is defined as a process of short-circuiting a transmission line than using humped components at very high frequencies during transmission. (2)

2.4
- Admittance calculations
- Calculations of the impedance at any point on any transmission line.
- Calculations of the length of a short-circuited piece of transmission line. (3)

2.5
$$\rho = \frac{ZL - ZO}{ZL - ZO}$$

$$= \frac{200 - j150 - 250 - j300}{200 - j150 + 250 + j300}$$

$$= \frac{-50 - j450}{450 + j150}$$

$$= \frac{452{,}769 \ /96.3^{\circ}}{474{,}342 \ /18{,}4^{\circ}}$$

$$= 0{,}955 \ / -77{,}9^{\circ}$$

$$\rho = \frac{VREF}{VINC}$$

$$\therefore VINC = \frac{VREF}{\rho}$$

$$= \frac{0{,}9 \ /30^{\circ}}{0{,}955 \ / -77{,}9^{\circ}}$$

$$= 0{,}942 \ / -47.9^{\circ}$$

(8)
[25]

QUESTION 3: ANTENNAS

3.1 Capture area is defined as the effective receiving area of a parabolic reflector which is calculated from the power received and its comparison with the power density of the signal being received. (3)

3.2 3.2.1 Radiation resistance is defined as the ration of the power radiated by the antenna to the square of the current at the feed point.

3.2.2 Beam width is defined as the angular separation between the two half-powered points on the power density radiation pattern.

3.2.3 Polarisation is defined as the direction in space of the electric vector of the electromagnetic wave radiated from an antenna, and is parallel to the antenna itself.

(3 x 3) (9)

3.3
- Antenna and ground resistance
- Discharge or corona effects
- Imperfect dielectrics very near to the antenna
- Eddy currents induced in metallic objects within the induction field of the antenna (4)

3.4 $\Pr = Pd \times A$

$$\therefore A = \frac{Pr}{Pd}$$

$$= \frac{12 \times 10^{-12}}{0{,}6 \times 10^{-12}}$$

$$= 20m^2 \longrightarrow$$

(7)
[23]

QUESTION 4: NOISE

4.1 Noise is any unwanted form of energy tending to interfere with proper and easy reception and production of wanted signals. (3)

4.2
- Atmospheric noise – Is generally called static and is caused by short waves on a receiver which is not well equipped to receive them
- Extra-terrestrial – Is caused by solar noise cosmic noise which is generated from the sun when it radiates over high broad frequency spectrum at high temperature and also by starts when they radiate in the same manner as the sun respectively
- Man-made noise – Is usually experienced in urban and suburban industrial areas and is created by man when using sources such as automobile and aircraft ignition, electric motors, switching gears and high voltage lines.

(3 x 3) (9)

4.3
$$£n = \sqrt{4kT\Delta fR}$$
$$= \sqrt{4 \times 1{,}38 \times 10^{-23} \times (17 + 273) \times 6 \times 10^{6} \times (300 + 200)}$$
$$= \sqrt{4 \times 1{,}38 \times 2{,}9 \times 6 \times 5 \times 10^{19}}$$
$$= \sqrt{48 \times 10^{-12}}$$
$$= 6{,}93\ \upsilon V$$

(4)
[16]

QUESTION 5: MODULATION AND DEMODULATION

5.1 $R_c = R_1 + R_2$ (7)

$= 110 + 220$

$= 330\ k\Omega$

$$Z_m = \frac{R_2 R_3 R_4}{R_2 R_3 + R_3 R_4 + R_4 R2} + R_1$$

$$= \frac{220 \times 470 \times 1\,000}{220 \times 470 + 470 \times 1\,000 + 1\,000 + 220} + 110$$

$= 130 + 110$

$= 240\ k\Omega$

$$M_{\max} = \frac{Zm}{R_c}$$

$$= \frac{240}{340}$$

$= 0{,}73$

$= 73\%$

5.2 5.2.1 Modulation is a process where a radio frequency or phase is changed in order to transmit intelligence or modulated signal

5.2.2 Demodulation is a process of extracting in formulation from a modulated signal or intelligence

(2 x 2) (4)

[11]

TOTAL: 100

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