DipIETE – ET (NEW SCHEME) – Code: DE57

Subject: NETWORKS AND TRANSMISSION LINES

Time: 3 Hours **DECEMBER 2009** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. If V_{th} and R_{th} are the thevenin's voltage and resistance, R_L is the load resistance then thevenin's equivalent circuit consists of

(A) series combination of R_{th} and V_{th}
(B) series combination of R_{th}, V_{th} and R_L
(C) parallel combination of R_{th}, V_{th} and R_L
(D) parallel combination of R_{th} and V_{th}

b. The laplace transfer of shifted unit step function $f(t) = u(t-a)$ is given by

(A) $\frac{a}{s+a}$ **(B)** $e^{-as}\left(\frac{1}{s}\right)$
(C) $\frac{1}{s+a}$ **(D)** None of the above.

c. In z parameter representation if $z_{21} = z_{12}$ then the network is

(A) bilateral **(B)** symmetrical
(C) balanced **(D)** inverse (reciprocal)

d. The characteristic impedance of a distortionless line is

(A) real **(B)** inductive
(C) capacitive **(D)** complex

e. For a prototype lowpass filter, the phase constant β in the attenuation band is

(A) α **(B)** π
(C) $\pi/2$ **(D)** 0

f. In a series resonant circuit, the resonant frequency will be

(A) geometric mean of half power frequencies.
(B) sum of half power frequencies.

(C) arithmetic mean of half power frequencies.
(D) difference of half power frequencies.

g. One neper is equal to

(A) 0.8686 db **(B)** 8.686 db
(C) 86.86 db **(D)** 19.686 db

h. Thevenin's theorem is valid for networks containing only

(A) reactive elements **(B)** non linear elements
(C) linear elements **(D)** bilateral network

i. VSWR on short circuited lossless line is given by:

(A) 0 **(B)** ∞
(C) Unity **(D)** None of above

j. Attenuators have

(A) attenuation and phase constant **(B)** gain only
(C) attenuation constant **(D)** gain and phase constant

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. Explain in detail different types of network elements. **(8)**

b. A current of 5A flows through a parallel combination of resistive network of 20Ω & 30Ω.Find the
(i) Power observed in the resistor.
(ii) Energy dissipated in the resistor/minute.
(iii) Charge flow through the resistor/minute.
(iv) Net resistance. **(8)**

Q.3 a. State superposition and maximum power transfer theorem. **(4+4)**

b. Use Millman's theorem to determine the voltage V_s of the network shown in Fig.1 given that $V_R = 230\angle 0^\circ V$,
$V_Y = 230\angle -120^\circ V$,
$V_B = 230\angle 120^\circ V$. **(8)**

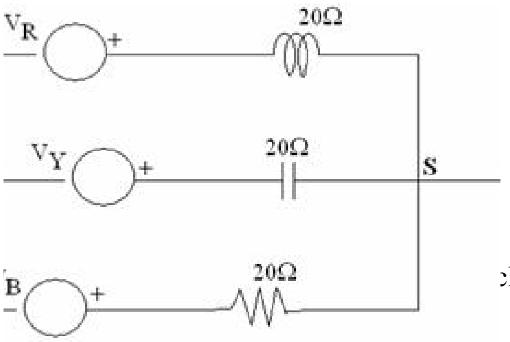


Fig.1

...cludes $1\mu f$ capacitor and a resistance of 16Ω. If the bandwidth is 500 rad/sec,

(ii) Q

(iii) L **(8)**

b. A two branch antiresonant circuit contains L = 0.4H, $C = 40\mu F$. The resonance is to be achieved by variation of R_L and R_C. Calculate the resonant frequency for the following cases:
(i) $R_L = 120\Omega$ $R_C = 80\Omega$
(ii) $R_L = 80\Omega$ $R_C = 0$
(iii) $R_L = R_C = 100\Omega$ **(8)**

Q.5 a. State and prove convolution theorem (Integral). **(8)**

b. Derive an expression for Laplace transform of an impulse function. **(8)**

Q.6 a. Define and derive expressions for
(i) Characteristic impedance.
(ii) Propagation constant.
(iii) Attenuation and phase constants of a transmission line in terms of primary constants.
(iv) Velocity of propagation. **(8)**

b. A certain telephone cable without loading has the following constants/Km $R = 25\Omega, L = 0.6MH$ $C = 0.04\mu F$ & G is negligible. The loading coils of inductance 45 mH and resistance 20 Ω are now placed at intervals of 1 Km. Calculate the attenuation/Km of loaded cable at 1000H and the highest frequency of transmission. **(8)**

Q.7 a. What is meant by impedance matching in transmission lines? Discuss briefly different impedance matching elements used. **(8)**

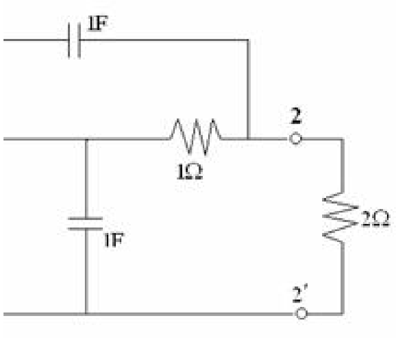
b. The terminating load of 4HF of transmission lines $z_o = 50\angle 0^0\Omega$ working at 300 MHz is $50 + j50\Omega$. Calculate VSWR and the position of the voltage minimum nearest to the load. **(8)**

Q.8 a. Derive an expression for design impedance of a symmetrical T attenuation. **(8)**

b. Derive an *m-derived T section low pass filter* having cutoff frequency $f_C = 1000Hz$, Characteristics impedance $R = 600\Omega$ & frequency of infinite attenuation $f_\alpha = 1050Hz$. **(8)**

Q.9 a. Derive the expression for ABCD parameters in terms of Y parameters. **(8)**

b. For the given bridge T network, find the driving point admittance Y_{11} and transfer admittance Y_{21} with a 2Ω load resister connected across port 2. **(8)**


1F
2
1Ω
2Ω
1F
2′