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Total Number of Pages : 02

B.Tech
PEE3I101

3rd Semester Back Examination 2019-20

NETWORK THEORY

BRANCH : ELECTRICAL

Max Marks : 100

Time : 3 Hours

Q.CODE : HB602

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.

The figures in the right hand margin indicate marks.

Part-I

Q1 Only Short Answer Type Questions (Answer All-10) (2 x 10)

- Which theorem obeys KVL and KCL?
- Define coefficient of coupling and its physical significance?
- Two coupled coils with $L_1 = 0.6 = L_2$ have a coefficient of coupling $K=0.8$. What is the the turn ratio $\frac{N_1}{N_2}$?
- Prove that resonant frequency is the geometric mean of the two half power frequencies?
- What is the fourier transform of step function?
- Write symmetry and reciprocity condition for Z parameter?
- What is the relation between resonant frequency and quality factor?
- A first order linear system is initially relaxed . For a unit step signal $u(t)$, the response is $v(t) = (1-e^{-3t})$ for $t > 0$. If a signal $3u(t) + \delta(t)$ is applied to the same initially relaxed system what will be the response ?
- What is the necessary and sufficient condition of Positive real function?
- An initially relaxed RC-series network with $R=2M \Omega$ and $c=1\mu F$ is switched on to a 10V step input. What is the Voltage across the capacitor after 2 seconds?

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- In a two-element series network , voltage $v(t)$ is applies, which is given by,
 $v(t) = 50 + 50\sin 5000t + 30\sin 10000t + 20\sin 20000t(V)$
The resulting current is given as
 $i(t) = 11.2\sin(5000t + 63.4^\circ) + 10.6\sin(10000t + 45^\circ) + 8.97\sin(20000t + 26.6^\circ) A$
Determine the network elements and the power dissipated in the circuit.
- A voltage, $v(t) = 100e^{-25t} u(t)$ volt is applied to the input of an ideal low- pass filter having a cut-off frequency of 25 rad/sec . Calculate the percentage of the total energy transmitted through the filter.
- The unit impulse response of current of a circuit having $R=1\Omega$ & $C = 1F$ in series is given by $[\delta(t) - \exp(-t)u(t)]$. Find the current expression when the circuit is driven by the voltage given as $[1 - \exp(-2t)] u(t)$.
- Find the network for the following in Foster 2 and Cauer 1 Form
$$Z(s) = \frac{2(s+1)(s+3)}{s(s+2)}$$
- The network equation for two port network give the current I_1 and I_2 at the two ports as
 $I_1 = 0.25V_1 - 0.2V_2$ and $I_2 = -0.2V_1 + 0.1V_2$
Determine the ABCD parameters for the Network and hence write the network equation.

f) A coil having a resistance of 50Ω and inductances 10mH is connected in series with a capacitor and is supplied at constant voltage and variable frequency source. The maximum current is 1A at 750Hz . Determine the bandwidth and half power frequencies.

g) Determine the impulse response of the linear system whose transfer function given as

$$H(j\omega) = \frac{3 + 2j\omega}{(j\omega)^2 + 6j\omega + 8}$$

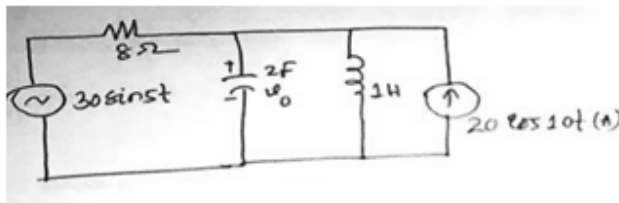
h) Write the limitation pole zero in a transfer function?

i) Synthesis the Foster II from network when its admittance function is given as

$$Y(s) = \frac{s(s^2+3)(s^2+5)}{(s^2+2)(s^2+4)}$$

j) The current in a 10 ohm resistor is $i(t)=10e^{-2t}u(t)(\text{A})$. What is the energy associated with the frequency band $0 \leq \omega \leq 2\text{ rad/s}$?

k) Find V_o using Thevenin's theorem in fig – 1.



l) A coil of inductance L and resistance R , in series with a capacitor is supplied at a constant voltage from a variable frequency source. Find the values of that frequency, in terms of R , L and ω_0 at which the circuit current would be half as much as at resonance .

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 For a series RLC circuit with $R=2\text{ ohm}$, $L=1\text{mH}$ and $C=0.4\mu\text{F}$ and a supply voltage **(16)**

$v(t)=20\text{ sin}\omega t$, find:(a) the resonant frequency ω_o , (b) The half power frequencies , (c)

The quality factor and bandwidth, (d) The amplitude of the current at ω_o .

Q4 a) Write a short note on Cut set and Tie set matrix with examples. **(8)**

b) Show that sum of energy stored by the inductor and capacitor connected in parallel RLC circuit at resonance at any instant is constant and is given by CV^2 . **(8)**

Q5 Design a high pass, constant-k type filter with T- section and π -section when the cut-off frequency is 8 KHz and the nominal characteristic impedance is 500Ω . Also determine **(16)**

the attenuation and phase constant for frequencies 5 KHz , 20 KHz .

Q6 A two terminal network consists of a coil with resistance R and inductance L Henries **(16)**

and it is shunted by a capacitor C . The poles and zero of the driving point impedance function $z(s)$ are poles $-\frac{1}{2} \pm j\frac{\sqrt{3}}{2}$, zero at -1 . If $(j0) = -1$, Determine the values of R , L and C .