Code: AE08 **Subject: CIRCUIT THEORY & DESIGN**
Time: 3 Hours **Max. Marks: 100**

DECEMBER 2010

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.**
- **The answer sheet for the Q.1 will be collected by the invigilator after half an hour of the commencement of the examination.**
- **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: (2x10)

a. The voltage across the terminals AB in the Fig.1 is

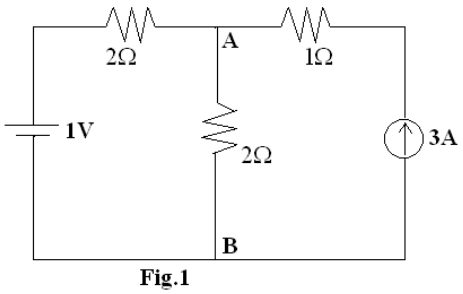

Fig.1

(A) 0.5 V
(B) 3.5 V
(C) 6 V
(D) 6.5 V

b. A tree of a graph must consist of

(A) b - n +1 branches **(B)** n – 1 brar
(C) b – n – 1 branches **(D)** n branches

c. The transform network representation of the inductor with initial current is

(A) $V_L(s) = L_s I_L(s) + LI_L(0^-)$ **(B)** $I_L(s)/L_s = V_L(s) + LI_L(0^-)$

(C) $V_L(s)/L_s = I_L(s) + LI_L(0^-)$ **(D)** $L_s I_L(s) = V_L(s) + LI_L(0^-)$

d. When the damping ratio $\xi = 0$, the poles of the system will be

(A) real and repeated **(B)** real and unrepeated
(C) Complex conjugate **(D)** imaginary

e. The rms value of a half wave rectified output is

(A) $I_m/2$ **(B)** $I_m/\sqrt{2}$

(C) $I_m/\sqrt{3}$ **(D)** $I_m/2\sqrt{3}$

f. The condition AD-BC = 1 for a two port network implies that the network is a

(A) Reciprocal Network **(B)** Lumped element Network
(C) Lossless Network **(D)** Unilateral element Network

g. A double tuned circuit have

(A) 4 real poles
(B) 2 real and 2 complex conjugate poles
(C) 2 pairs of conjugate poles
(D) A pair of conjugate poles and zeros.

h. A polynomial P(s) is said to be Hurwitz if

(A) P(s) is real when S is real
(B) the roots of P(s) have real parts which are zero or negative
(C) both (A) and (B)
(D) none of the above

i. The property of an RL impedance is that poles and zeros are located

(A) On the negative real axis, and they alternate
(B) On the positive real axis, and they alternate
(C) On the $j\omega$ axis, and they alternate.
(D) On the negative $j\omega$ axis, and they alternate.

j. Linear phase response of the filter is obtained by

(A) Butterworth
(B) Chebyshev
(C) Bessel
(D) None of the above

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

Q.2 a. Explain any two dependent sources. **(8)**

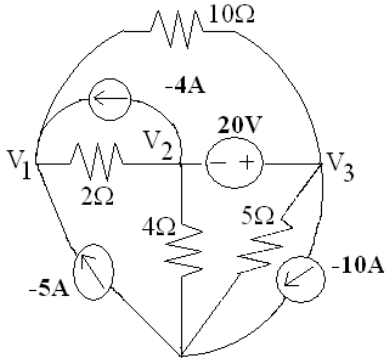

Fig.2

b. Determine the nodal voltages V_1, V_2 and V_3 in the circuit shown in Fig.2. **(8)**

Q.3 a. Draw the dual of the network shown in Fig.3. **(6)**

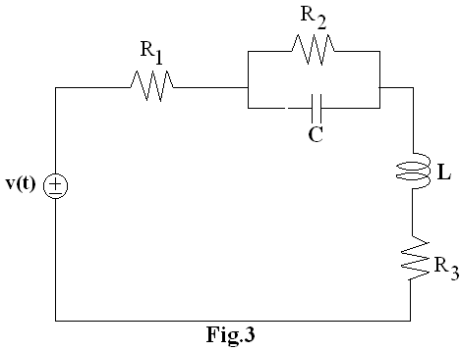

Fig.3

b. For the transformer circuit shown in Fig.4, the excitation v = 10 u(t). Find $i_1(t)$ and $i_2(t)$ assuming $i_1(0^-) = i_2(0^-) = 0$ **(10)**

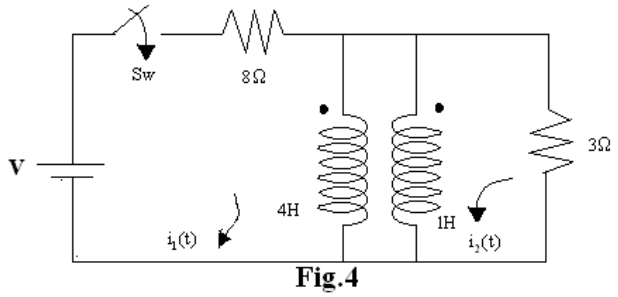

Fig.4

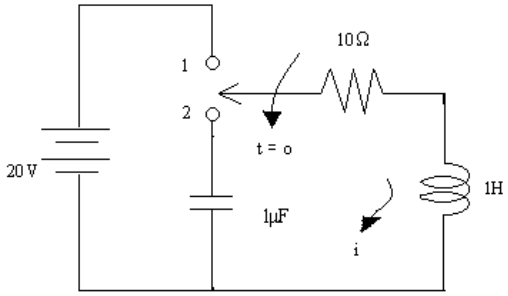

Fig.5

Q.4 a. In the circuit shown in Fig.5, switch k is changed from 20V to 1 μF at time t=0, steady state condition having been reached before switching, find the values of i , $\frac{di}{dt}$ at t =0+. **(6)**

b In the network shown in Fig.6, the switch closes at t =0. If v(t) = 0.1 e^{-5t} and all the initial currents and voltages are zero. Find the current $i_2(t)$ by Norton's theorem. **(10)**

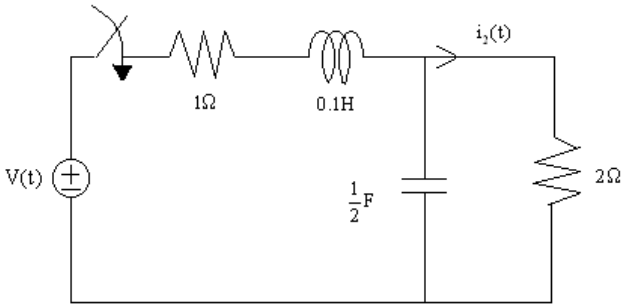

Fig.6

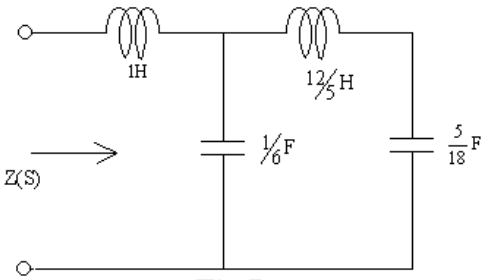

Fig.7

Q.5 a. For the network shown in Fig.7, find the transform impedance Z(s) in the factorised form. **(10)**

b. Describe sine function using exponential excitation. **(6)**

Q.6 a. For the network shown in Fig.8, determine the impedance Z_x such that maximum power is transferred from the source to load of impedance Z_x **(6)**

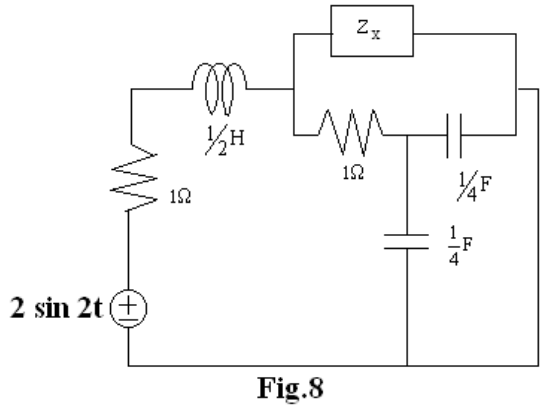

Fig.8

b. The system response of tuned circuit is given by $H(s) = \frac{5}{s^2 + 2s + 5}$.

Determine ω_{max}, $|H(j\omega_{max})|$, the half power point ω_C and $|H(j\omega_C)|$ **(10)**

Q.7 a. Obtain Y parameters interms of Z- parameters **(8)**

b. Determine the h-parameters for the network shown in Fig.9. **(8)**

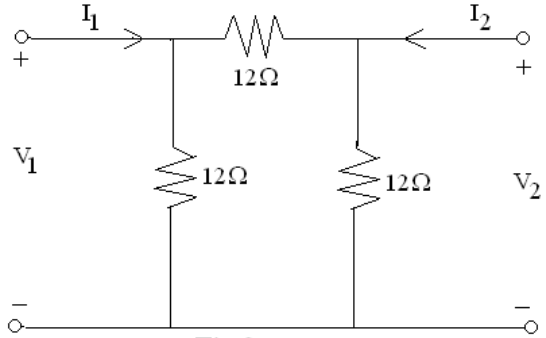

Fig.9

Q.8 a. Determine whether the function $F(s) = \frac{s^2 + 4}{s^3 + 3s^2 + 3s + 1}$ is a positive real function. **(8)**

b. For the network shown in Fig.10, find Y when $\frac{V_2}{V_o} = \frac{1}{2 + Y} = \frac{s(s^2 + 3)}{2s^3 + s^2 + 6s + 1}$ synthesize Y as an LC – admittance. **(8)**

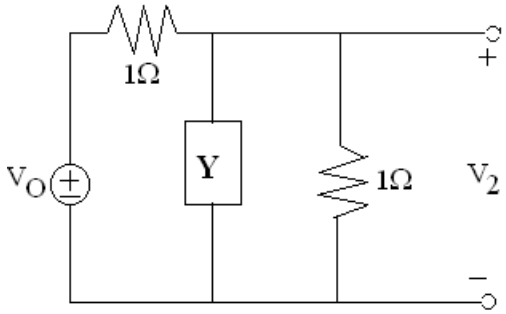

Fig.10

Q.9 Determine the system fu **(16)**

(i) Ripple of $\frac{1}{2}$ db in band $|\omega| \leq 1$

(ii) At $\omega = 3$, amplitude is down 30db