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

JUNE 2011

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 45 Minutes 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: **(2×10)**

a. Current of 3A flows through a resistance of 20 ohms. The energy dissipated in the resistor per minute is

(A) 1.80 W **(B)** 0.18 W
(C) 3.6 W **(D)** 180 W

b. A Hurwitz polynomial has

(A) only zeros in the left half of s-plane
(B) only poles in the left half of s-plane
(C) zeros anywhere in s-plane
(D) poles anywhere in s-plane

c. The function Z(s) is Z(s)= s(s+3)/(s+2) (s+4)

(A) L-C **(B)** R-C
(C) R-L **(D)** R-L-C network

d. In a two port network, the condition for reciprocity in terms of h-parameters is

(A) $h_{12} = h_{21}$ **(B)** $h_{11} = h_{22}$
(C) $h_{11} = -h_{22}$ **(D)** $h_{12} = -h_{21}$

e. A series RLC circuit consist of resistance 10 ohms, and inductance of 0.1H, capacitance of $0.001\,\mu F$. The frequency at resonance

(A) 10^5Hz **(B)** 10^7Hz
(C) 15920Hz **(D)** 920Hz

f. In a linear network, the ratio of voltage excitation to current response is unilateral when the position of excitation and response are interchanged. This is

(A) Principle of duality **(B)** Reciprocity theorem
(C) Tellegan's theorem **(D)** Principle of superposition

g. If the source impedance is 3 + 4j, then for maximum power transfer, the load impedance should be

(A) 3 **(B)** 4
(C) 3-4j **(D)** -4j

h. An RC circuit has a capacitor C = 2 μF in series with a resistance R=1MΩ.The time of 6 secs will be equal to

(A) one time constant **(B)** two time constant
(C) three time constant **(D)** none of these

i. Quality of a coil is defined as

(A) Q =ωL/R **(B)** Q =ωC/R
(C) Q =ωR/L **(D)** Q =ωCL/R

j. If all the elements in a particular network are linear, then the superposition theorem would hold, when the excitation is

(A) dc only **(B)** ac only
(C) ac or dc **(D)** an impulse

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

Q.2 a. Determine i(0+), di/dt(0+), and d^2i/dt^2 (0+) in the given Fig.1 if V=10 V, R= 10 Ω, L = 1 H, C= 10μF and V_c=(0). **(8)**

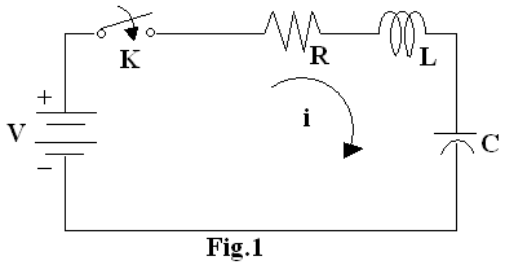

Fig.1

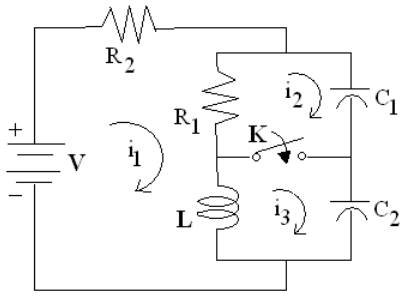

Fig.2

b. In the given Fig.2, find the initial values of all three loop currents when a steady state is reached with the switch K open, and at t=0 the switch is closed. **(8)**

Q.3 a. Using Nodal analysis, find the node voltages V_1 and V_2 in Fig.3. **(6)**

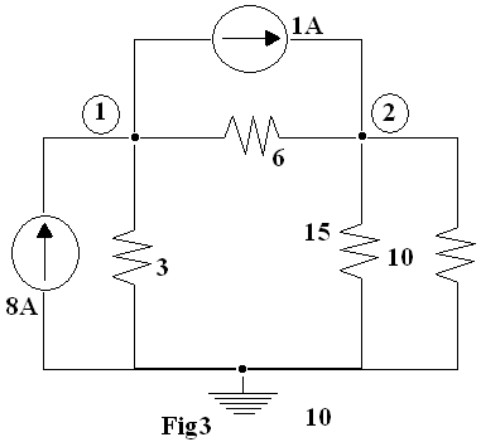

Fig3

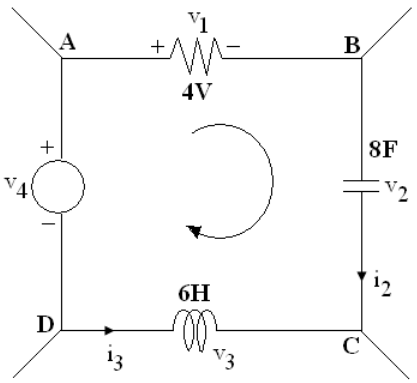

Fig.4

b. In the network shown in Fig.4 v_1= 4 V, v_4= 4 cos 2t and $i_3 = 2e^{-t/3}$. Determine i_2. **(6)**

c. Applying Kirchhoff's laws to different loops in Fig.5, find the values of V_1 and V_2. **(4)**

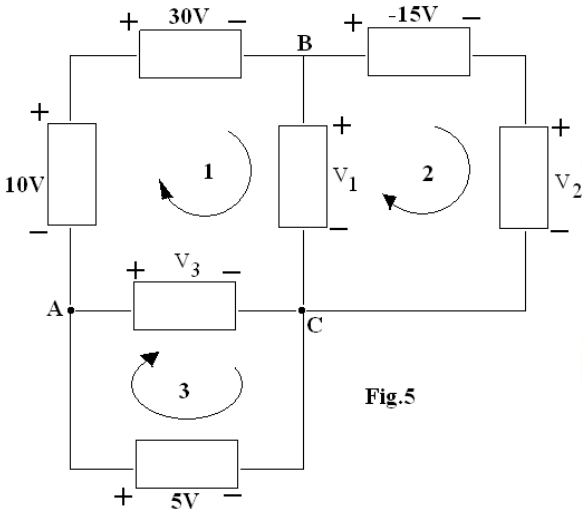

Fig.5

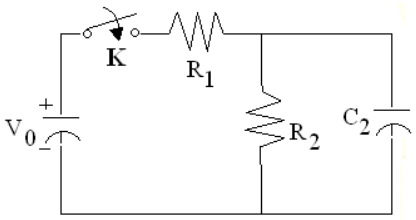

Fig.6

Q.4 a. In the given Circuit (Fig.6) Find the current in the resistor R_2. Assuming capacitor C_2 is initially uncharged. The switch K is closed at t=0. **(8)**

b In the network given in Fig.7 the switch closes at t=0. It is given that v (t)= 0.1 e^{-5t} , R_2= 2 ohms and all intial currents and voltages are zero. Find the current i_2 by Norton's theorem. **(8)**

Q.5 a. Consider the network in Fig.8 find the values of node voltages V_1 (t) and V_2(t). Assume at t=0, switch is open. It is given that L=1/2 H, C = 1 F, G=1mho, V=1V. **(8)**

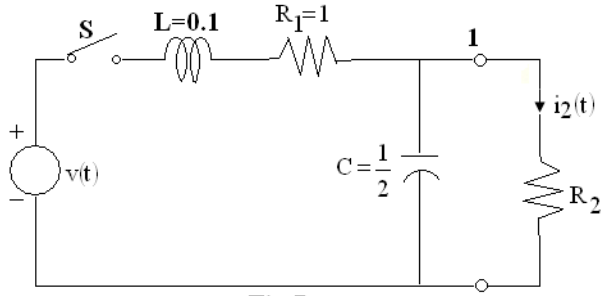

Fig.7

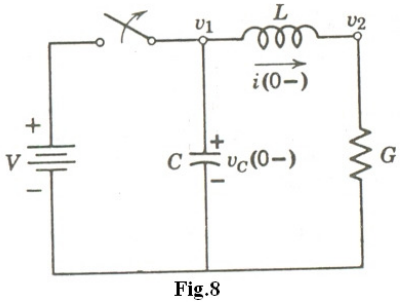

Fig.8

b. What do you understand by sinusoidal steady state system?
For the network of Fig.9, find i_2 in the steady state if v_1 = cos 2t, the values of L=1 H, C= ½ F and R=2Ω. **(4+4)**

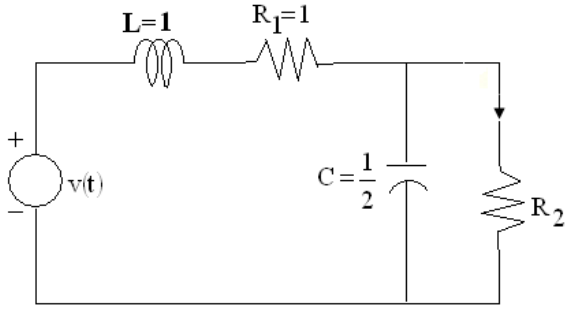

Fig.9

Q.6 a. Calculate the following for half wave alternating current
(i) Average value (ii) Rms Value
(iii) Form factor **(4+2+2)**

b. State and prove Maximum Power transfer theorem. Give its applications also. With the help of superposition theorem, obtain the value of current I and voltage V_o in the Fig.10. **(4+4)**

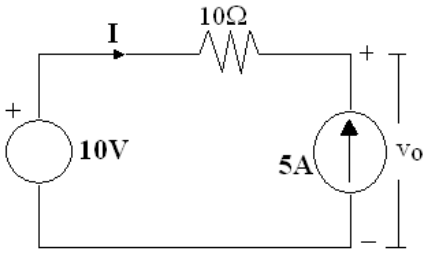

Fig.10

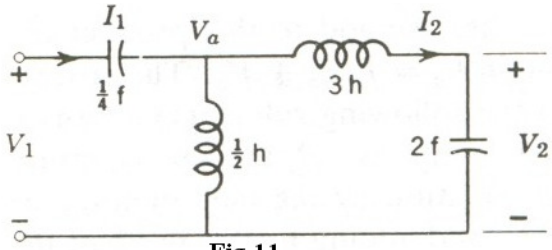

Fig.11

Q.7 a. Find the voltage ratio V_2/V_1, the current ratio I_2/I_1, input impedance Z_1 and the transfer impedance Z_{21} for the network given in Fig.11. **(8)**

b. Find the short circuit admittance functions y_{11} and y_{21} for the network in Fig.12. **(8)**

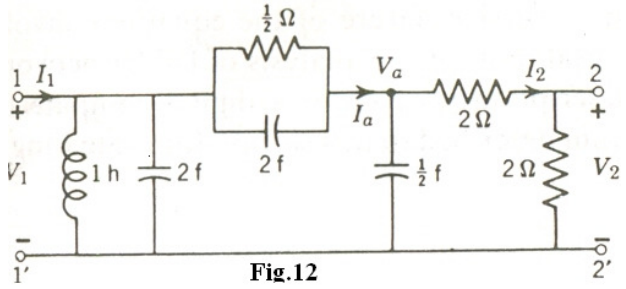

Fig.12

Q.8 a. Synthesise the Cauer–I form of given admittance function
$$z(s)=\frac{(s+1)(s+3)}{s(s+2)}$$ **(8)**

b. Check whether the polynomial s^5+2s^3+4s is Hurwitz or not. **(8)**

Q.9 a. Design constant k of low pass filter having cut off frequency= 3000Hz and nominal characteristic impedance $R_0=600\Omega$. **(8)**

b. Design and derive T and π-sections low pass filter for nominal characteristic impedance $R_0=600\Omega$, cut off frequency=1800Hz and infinite attenuation frequency $f_\infty=2$KHz. **(8)**