ROLL NO. _____

Code: AE59/AE110 **Subject: CIRCUIT THEORY & DESIGN**

AMIETE – ET (Current & New Scheme)

Time: 3 Hours **December - 2017** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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.**

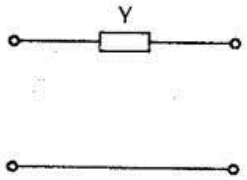
Q.1 Choose the correct or the best alternative in the following: (2×10)

a. The power consumed in a circuit element will be least when the phase difference between the current and voltage is
(A) 180° **(B)** 90°
(C) 60° **(D)** 0°

b. The power factor at resonance in R- L - C parallel circuit is
(A) zero **(B)** 0.08 lagging
(C) 0.8 leading **(D)** unity

c. The condition for reciprocity of a two port network having different parameters are: (1) $h_{11}= -h_{21}$ (2) $g_{12}= -g_{21}$ (3) A=D
choose the correct combination
(A) (1) and (2) **(B)** (1) and (3)
(C) (2) and (3) **(D)** (1), (2) and (3)

d. For the two port network shown below, select the correct statement.



(A) It does not have Z parameter **(B)** It have Z parameter
(C) It does not have Y parameter **(D)** It does not have ABCD parameter

e. A lattice network has its series and shunt arms 50 Ω and 60 Ω. Its equivalent T network has total series resistance and shunt resistance are respectively:
(A) 100 Ω, 55 Ω **(B)** 100 Ω, 50 Ω
(C) 100 Ω, 5 Ω **(D)** None of these

f. The system described by the equation
$F(s) = S^4+2S^3+3S^2+6S+K$, according to Routh-Hurwitz's criterion, is
(A) unstable for all values of K **(B)** stable if K>0
(C) stable if K<0 **(D)** stable for all values of K

g. Time constant of an inductive circuit
(A) increases with increase of inductance and decrease of resistance
(B) increases with the increase of inductance and the increase of resistance
(C) increases with decrease of inductance and decrease of resistance
(D) increases with decrease of inductance and increase of resistance

h. In R-L-C series resonant circuit magnitude of resonance frequency can be changed by changing the value of

(A) R only **(B)** L only
(C) C only **(D)** L or C

i. If F_1 (s) and F_2(s) are two positive real function (PRF) then the function which is always positive real is

(A) F_1 (s) F_2(s) **(B)** F_1 (s) / F_2(s)
(C) [F_1 (s) F_2(s)] / [F_1 (s) + F_2(s)] **(D)** F_1 (s) - F_2(s)

j. An RC driving point impedance function has zeros at s = -2 and s= -5. The admissible poles for the function would be

(A) s = 0 and s= -6 **(B)** s = -1 and s= -3
(C) s = 0 and s= -1 **(D)** s = -3 and s= -4

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

Q.2 a. State and prove the Initial value theorem and Final value theorem related to Laplace Transform. **(6)**

b. Determine the Unit Step response of the circuit shown in Fig. 2.b using Laplace transform. Assume Zero initial conditions. **(10)**

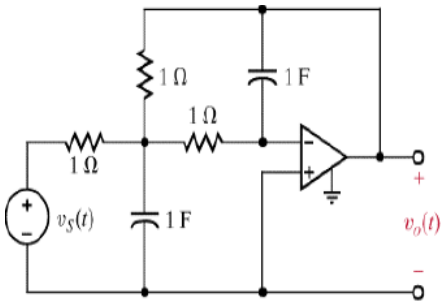


Fig. 2.b

Q.3 a. Find the current in 10 Ω resistance in the circuit shown (Fig 3.a) by Thevenin's theorem and confirm the result by Norton's theorem. **(6)**

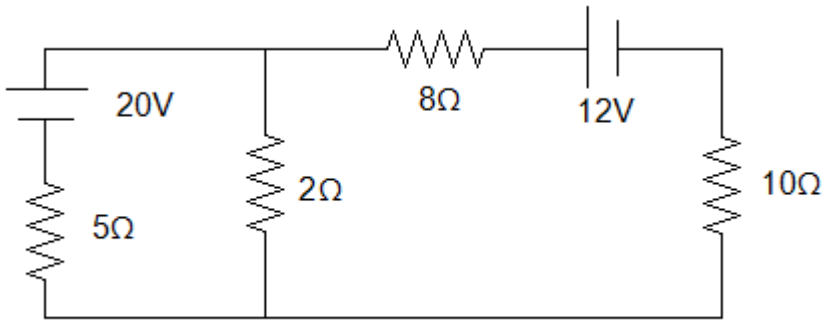


Fig 3.a

b. State Kirchoff's voltage and current law. Show that these laws follow from the principles of conservation of energy and charge. **(5)**

c. What do you mean by Duality? Illustrate with example. **(5)**

Q.4 a. If two four terminal networks are connected in Parallel find the equivalent network parameter of the combination circuit. **(6)**

b. Find the Y and Z parameters for the RC ladder network shown in fig. 4.b. **(10)**

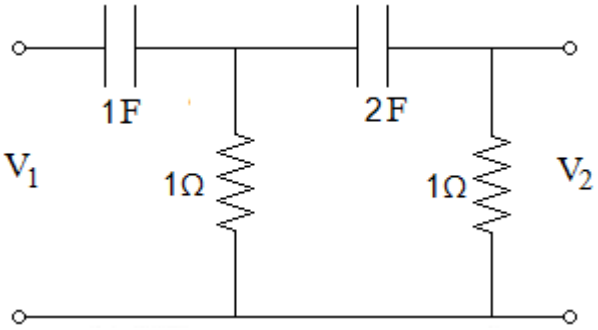


Fig. 4.b

Q.5 a. Draw the transform impedance and admittance representation of Resistance, Inductance and Capacitance with suitable initial conditions. **(8)**

b. A voltage pulse of height "V" and duration "a" is applied to the series RC network at t=0. Determine the current response of the circuit. **(8)**

Q.6 a. Derive the generalized formula for determining the order of Butterworth filter. **(6)**

b. For an analog filter approximation, let the pass band tolerance be 1 dB extending from 0 to 1 KHz and the stop band tolerance is -40 dB with the edge of 5 KHz. Find the Butterworth TF. What will be the order of the filter if we design Chebyshev filter. **(10)**

Q.7 a. Check if the polynomial
(i) $P(s) = 2S^4+5S^3+6S^2+2S+1$ (ii) $P(s) = S^5+3S^3+S$
is Hurwitzian or not. **(6)**

b. What are the properties of positive real function? **(4)**

c. Explain the basic synthesis procedure for R-L-C functions **(6)**

Q.8 a. What are the properties of transfer function? **(6)**

b. Synthesise a network which has the impedance function

(i) $Z(S) = \dfrac{5S^3+2S^2+3S+1}{5S^3+3S}$ (ii) $Z(S) = \dfrac{(S^2+2)(S^2+4)}{S(S^2+3)(S^2+5)}$ **(10)**

Q.9 a. Explain zeros of transmission with the help of necessary circuits. **(6)**

b. Circuit shown in Fig. 9.b is at rest for t<0. Determine the current through inductor and voltage across capacitor for t>0. **(10)**

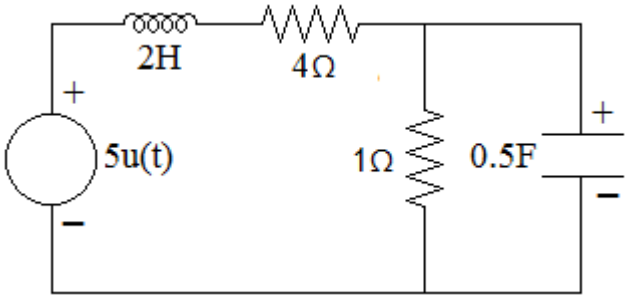


Fig. 9.b