ROLL NO. ___________________

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

# AMIETE – ET

**Time: 3 Hours** **JUNE 2014** **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. To a highly inductive circuit, a moderate value capacitance is added in series. The angle between voltage and current will

**(A)** decrease **(B)** remain same
**(C)** increase **(D)** indeterminist

b. Kirchoff's first law is used in the formation of

**(A)** Loop equation **(B)** Nodal equation
**(C)** Duality **(D)** Convolution integral

c. Superposition theorem is not applicable in

**(A)** voltage responses **(B)** current responses
**(C)** power responses **(D)** none of these

d. The current in circuit changes according to $i = 2e^{-t}$ Ampere for $t \geq 0$ and $i = 0$ for $t < 0$. The total charge passes to the circuit in Coulombs is

**(A)** 8 **(B)** 4
**(C)** 1 **(D)** 2

e. The circuit shown in Fig.1 is

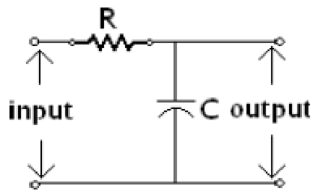


Fig.1

**(A)** High pass filter **(B)** Low pass filter
**(C)** All pass filtter **(D)** An attenuator

f. An L-C immittance function

**(A)** has simple poles and zeros in the left half of the s-plane
**(B)** has no zero or pole at the origin or infinity
**(C)** is an odd rational function
**(D)** has all poles on the negative real axis of the s-plane

g. A network function can be completely specified by
**(A)** Poles, zeros and a scale factor **(B)** zeros and a scale factor
**(C)** Poles and zeros **(D)** Poles and a scale factor

h. Laplace transform of a unit impulse function is

**(A)** $1/s^2$ **(B)** 1
**(C)** 1/s **(D)** s

i. An RLC series circuit is said to be inductive if

**(A)** $\omega L = 1/\omega C$ **(B)** $\omega L < 1/\omega C$
**(C)** $\omega L = \omega C$ **(D)** $\omega L > 1/\omega C$

j. For a two - port reciprocal network, the three transmission parameters are given as A = 4, B = 7 and C = 5. The value of D is equal to

**(A)** 8 **(B)** 9
**(C)** 3 **(D)** 5.8

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

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**Q.2** a. For the circuit shown in Fig.2, determine (i) its graph (ii) its oriented graph (iii) trees. **(1+1+2)**

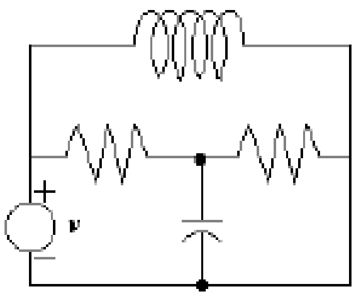


**Fig.2**

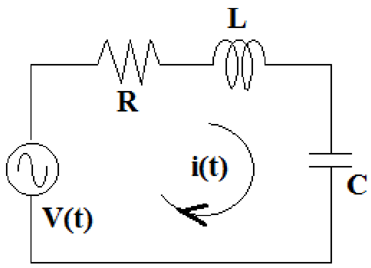


**Fig.3**

b. Define duality. Obtain dual of network shown in Fig.3. Write integro-differential equation for both. **(1+3)**

c. Write various steps involved for loop analysis. Find the power dissipated in the 4Ω resistor in the circuit shown in Fig.4 using loop analysis. **(4+4)**

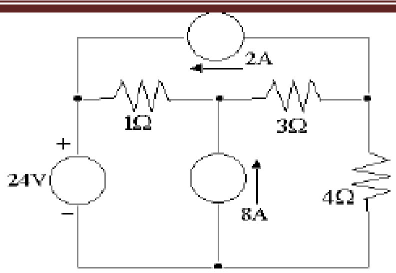


**Fig. 4**

**Q.3** a. After steady-state current is established in the R-L circuit shown in Fig.5 with Switch S in position 'a' the switch is moved to position 'b' at t = 0. Find $i_L(0+)$ and $i(t)$ for t > 0. What will be the value of i(t) when t = 4 seconds? **(8)**

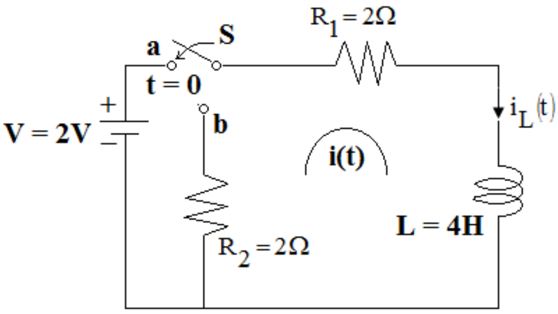


**Fig.5**

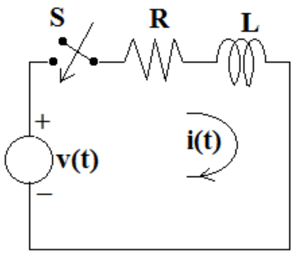


**Fig.6**

b. In the given network of Fig.6, the switch S is closed at t=0.The voltage source follows the law $v(t) = Ve^{-\alpha t}$ , where α is a constant. Solve for the current assuming that (i) $\alpha \neq R/L$ (ii) $\alpha = R/L$. **(8)**

**Q.4** a. At t = 0, a switch is closed, connecting a voltage source V to a series RC circuit. Find the expression for current by using method of Laplace transform. Assume capacitor has no initial charge. **(8)**

b. State and prove initial value theorem and final value theorem for Laplace transform. Obtain initial value for the function $F(s) = 2(s+1) / s^2+2s+5$ **(8)**

**Q.5** a. State and prove reciprocity theorem. Write its application. **(8)**

b. Obtain the transform impedance representation for a capacitor and an inductor. For initial conditions in the network, how they are transformed? **(8)**

**Q.6** a. Discuss the time domain behaviour from the pole and zero plot. **(10)**

b. Determine whether the polynomial are Hurwitz or not.
(i) $F(s)= s^3+ 2s^2 + s + 2$
(ii) $F(s) = s^4 + s^3 +2s^2 +2s+1 = 0$ **(2×3)**

**Q.7** a. State the condition of two port network to be reciprocal and symmetrical in terms of Z, h , ABCD & Y parameters**.** **(4)**

b. Explain twin –T network. **(4)**

c. For the circuit as shown in Fig.7, find the Y-parameters. **(8)**

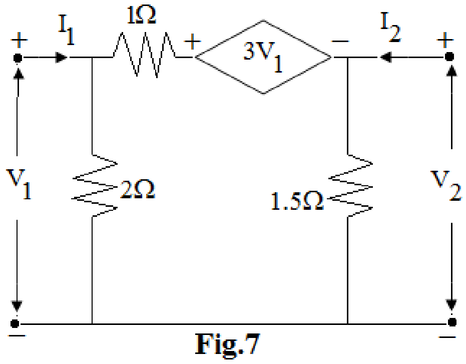


**Fig.7**

**Q.8** a. Obtain (i) Foster –I form realization and (ii) Cauer –II form realization for

$$Z(s) = 2\,(s+1)\,(s+3) / s(s+2)$$ **(8)**

b. Synthesize $Z(s) = (s^2 + 5s + 4) / (s^2 + 5s + 6)$ using partial fraction expansion method. **(8)**

**Q.9** a. Discuss how the element change in Frequency Transformations used for filter design. **(8)**

b. Realise $H(s) = s / \{s^3 + s^2 + 3s + 1\}$ as a network terminated by 1Ω resistor. **(8)**