This question paper contains **8+3** printed pages]

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S. No. of Question Paper : **7981**

Unique Paper Code : **2511102**   **F-1**

Name of the Paper : **Circuit Analysis [DC-1.1]**

Name of the Course : **B.Tech. Instrumentation**

Semester : **I**

Duration : **3 Hours**   Maximum Marks : **75**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Instructions for Candidates :

Attempt any *Five* questions in all.

Question No. **1** is compulsory.

Use of non-programmable scientific calculator is permitted.

1.   (*a*)   Determine the power delivered by the voltage source V in terms of '*a*' in Fig. 1. Also determine the power delivered when :
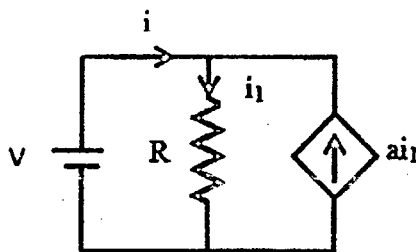
(*i*) $a = 0$

(*ii*) $a = 1$.

Fig. 1

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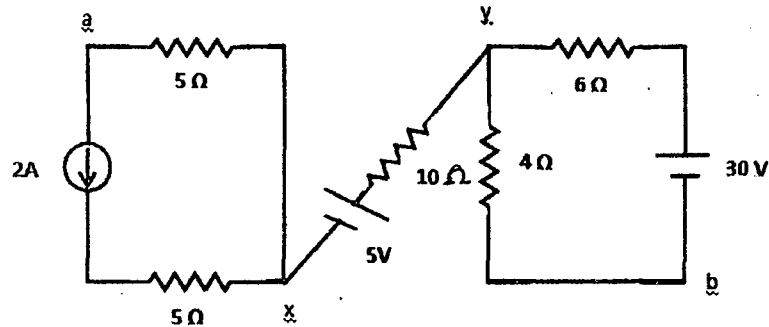(*b*) Calculate the voltage V_{ab} and V_{xy} in the circuit shown below in Fig. 2.

Fig. 2

(*c*) In Fig. 3, switch is closed at $t = 0$ sec.

   (*i*) Determine the power delivered to the load resistance. What current an ammeter will show if it is connected in series with the load resistor ?

   (*ii*) Suddenly the ammeter value drops to 0 amperes. Explain the reason. (Current rating of the load resistor is 0.5 ampere).
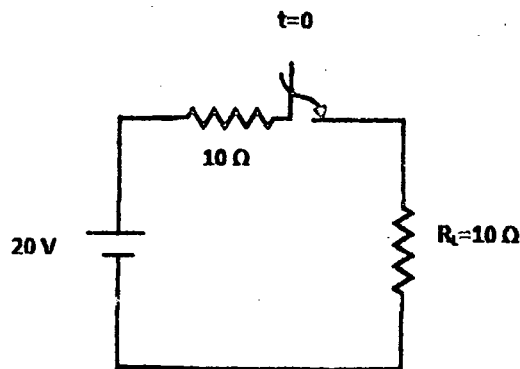

Fig. 3

(d) Draw its equivalent :

(i) Star Equivalent for Fig. 4(a).
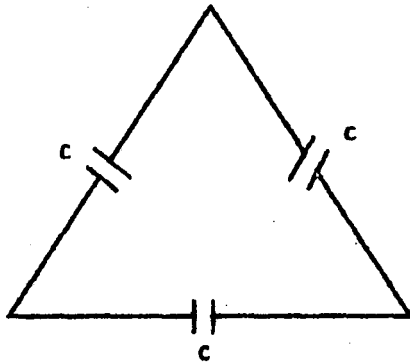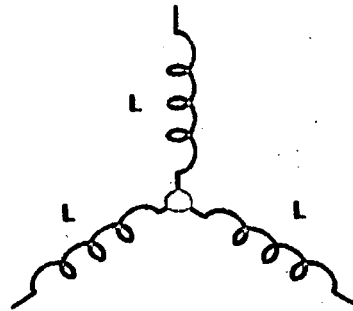
(ii) Delta Equivalent for Figure 4(b).

Fig. 4(a)   Fig. 4(b)

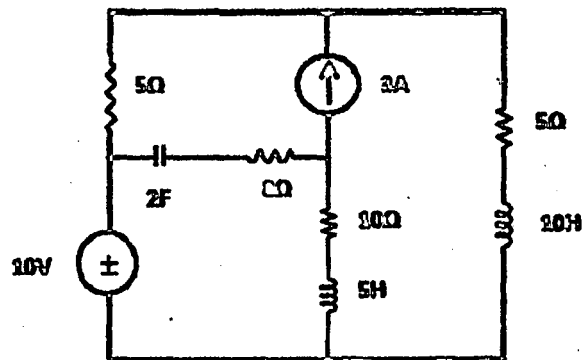(e) Draw the dual of the circuit shown below in Fig. 5.   5×3=15

Fig. 5

2. (a) Determine the current in all the three branches and verify the Tellegan's theorem for the
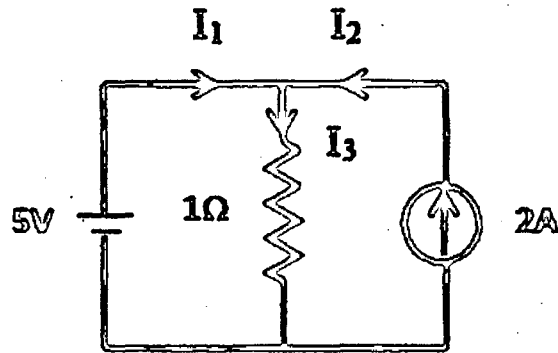
circuit shown below Fig. 6.

Fig. 6

(b) Determine the voltage across and the current through load using Millman's Theorem for
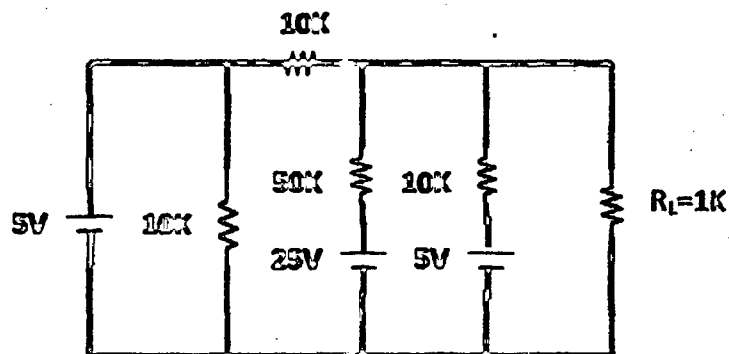
the circuit shown below Fig. 7.

Fig. 7

(c) Determine the current in all the branches using Mesh analysis shown below in Fig. 8.
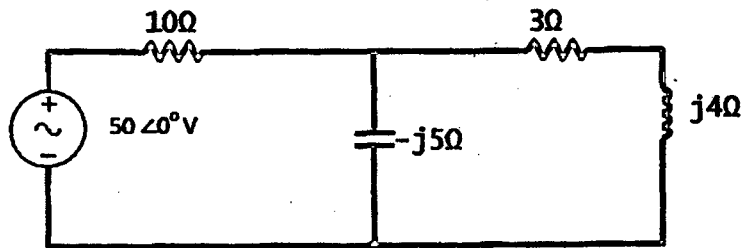
5+5+5=15

Fig. 8

3. (a) Draw the Thevenin's equivalent of the circuit shown below in Fig. 9 and also calculate

the current through load resistance.

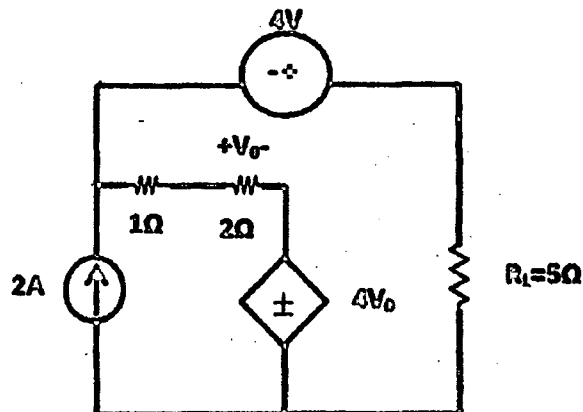
Fig. 9

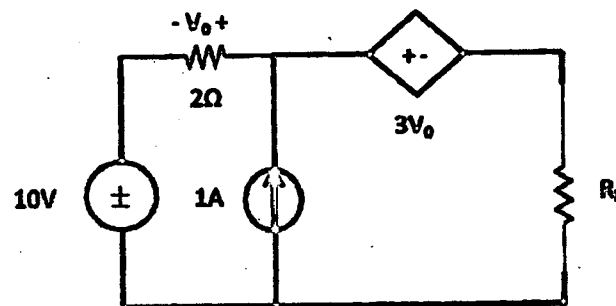(b)   What will be the maximum power delivered to the load in the circuit shown below in Fig. 10 ?

Fig. 10

(c)   Calculate the value of new currents of circuit shown below in Fig. 11 using the compensation theorem when the load resistance R_L is increased by 25%. Also verify the compensation theorem.   4+5+6=15
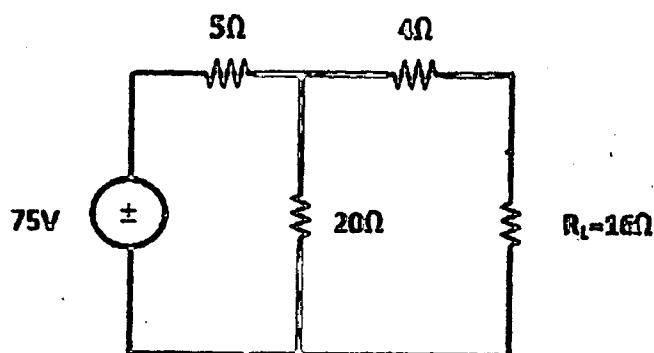

Fig. 11

4. (*a*) What is real and reactive power ? Why the transformer rating is in VA (volt ampere) and not in watts ?

(*b*) In a series RLC combination with R = 2 ohms, L = 1.6 milliHenry, C = 20 μF passes current of i = 3 sin(5000t – 60°) amp. Find the voltage across each element and the total voltage. Does voltage lead or lag current ?

(*c*) Draw and calculate the average value of the full wave rectified signal.

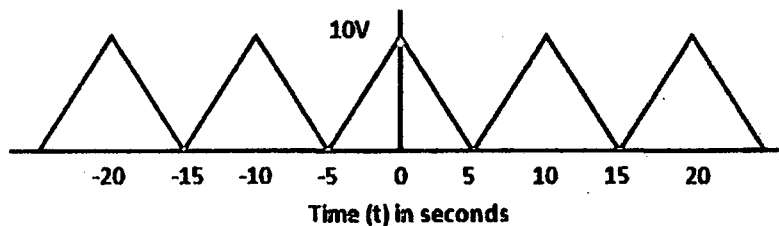(*d*) Calculate the rms value of the periodic signal shown in Fig. 12.   3+5+3+4=15

Fig. 12

5. (*a*) In the circuit shown in Fig. 13, the switch is moved from position 1 to position 2 at *t* = 0. Calculate the voltage across both the capacitor $V_{20\mu F}(t)$ and $V_{6\mu F}(t)$

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and voltage across the resistor of 20 KΩ i.e. $V_{20K\Omega}(t)$. Also plot the voltage of
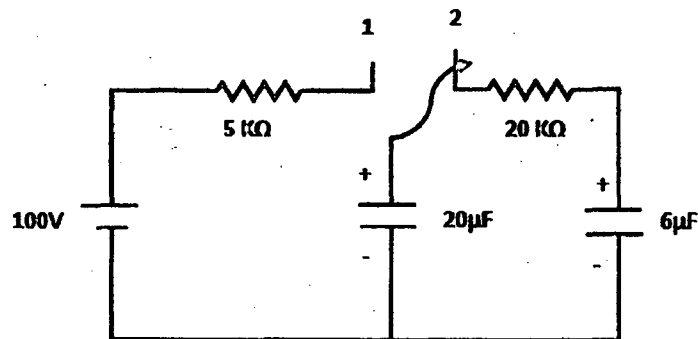
capacitors as a function of time.

Fig. 13

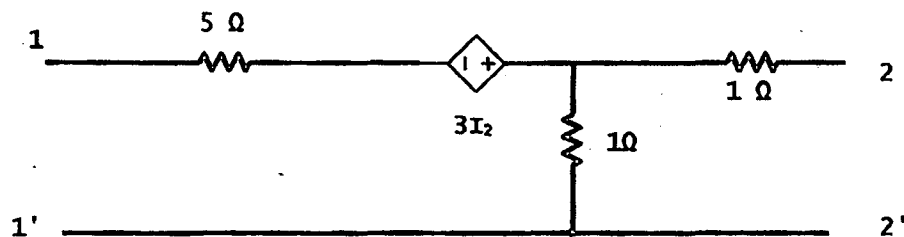(b)   Find Z parameters of two port network shown below in Fig. 14.

Fig. 14

(c)   For the RL circuit shown below in Fig. 15, find the current i_L for the following

times :

(i) $t = -1$ ms

(ii) $t = 0^+$

(iii) $t = 0.3$ ms

(iv) $t = \infty$ 7+4+4=15
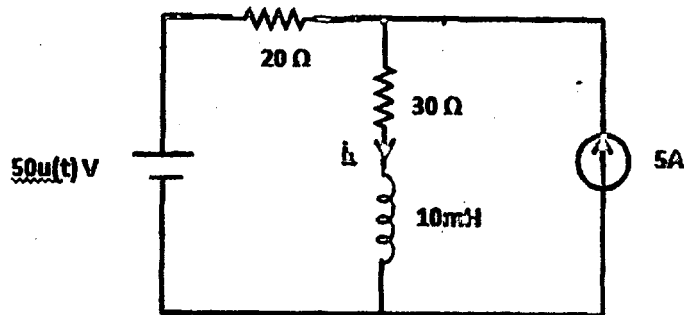

20 Ω

30 Ω

50u(t) V

10mH

5A

Fig. 15

6. (a) Calculate the voltage V_{ab} using the Superposition Theorem and also make its Norton

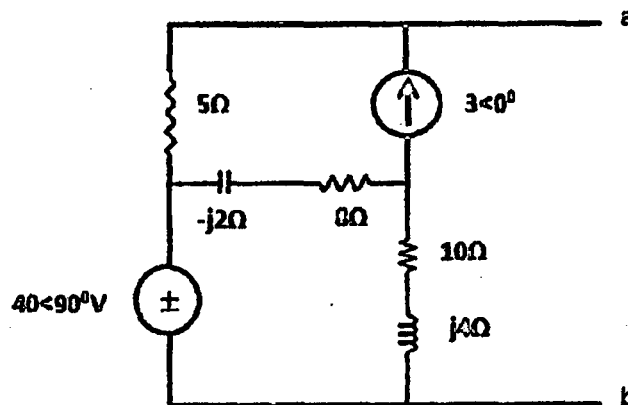equivalent of circuit shown below in Fig. 16. Also plot the impedance diagram.

a

5Ω

3<0⁰

-j2Ω

8Ω

10Ω

40<90⁰V   ±

j4Ω

b

Fig. 16

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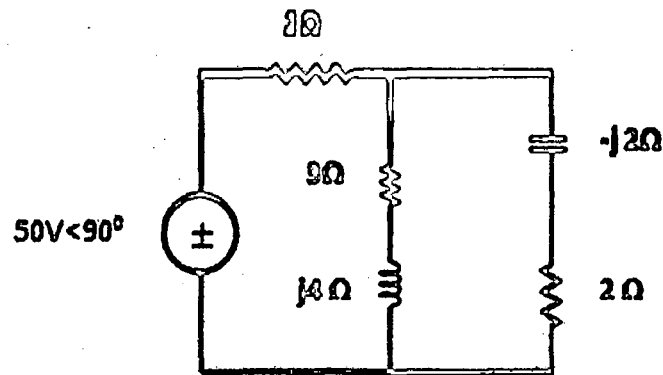(b)   Verify the reciprocity theorem for the circuit shown below in Fig. 17.   9+6=15

Fig. 17

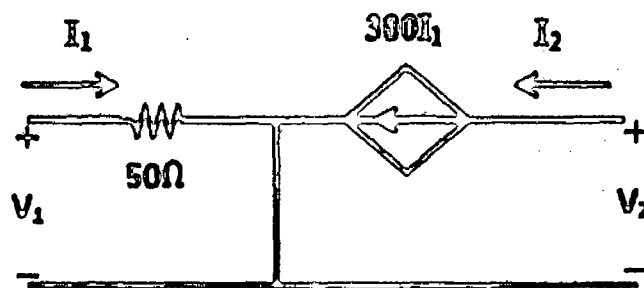7.   (a)   Calculate the z and h parameters of the network shown below in Fig. 18.

Fig. 18

(b) State and prove maximum power theorem for Impedance networks.

(c) What is the reciprocity condition for the *h*-parameter and ABCD parameters ?

(d) Design a passive high pass RC filter with roll of rate 20 db/decade and cut-off frequency 5 kHz. Also plot the frequency response of ideal and practical filter of same type. How many capacitors and inductors are needed to design a low pass filter with roll of rate 80 db/decade ?   4+5+1+5=15