2021

ELECTRONICS — GENERAL

First Paper

Full Marks : 100

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Group - A

Answer ***question no.* 1** and ***any four*** from the rest, taking ***two*** from each of **Unit-I** and **Unit-II**.

1. Answer ***any five*** questions : 2×5

(a) State Kirchoff's current law.

(b) Define mutual inductance.

(c) Define one Farad of capacitance.

(d) State Norton's theorem.

(e) Write down the expression for the energy stored in an inductor.

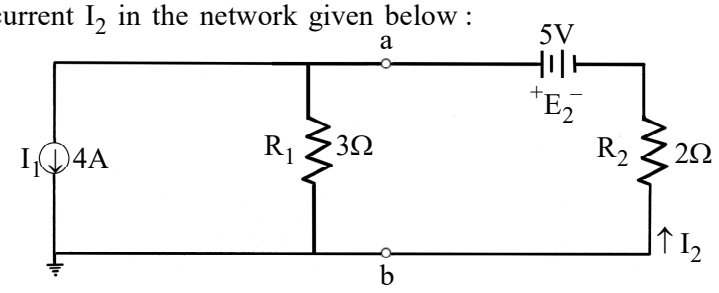
(f) Define resistivity of a conductor.

(g) Draw the equivalent circuit of a practical voltage source.

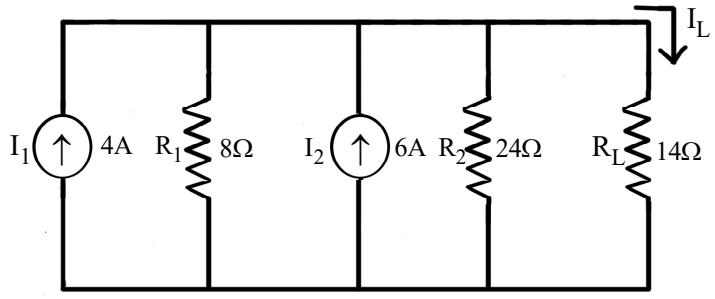
(h) State Maximum Power Transfer theorem.

Unit - I

2. (a) Determine current I_2 in the network given below :



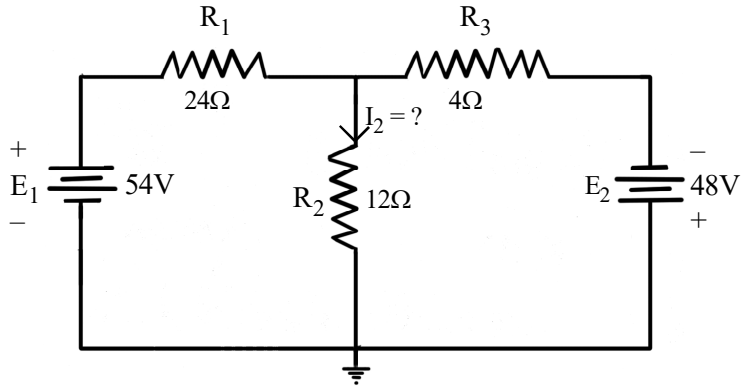
(b) Reduce the network given below to a single current source and calculate the current (I_L) through R_L.



5+5

3. (a) State Superposition theorem.

(b) Using Superposition theorem, determine the current through the 12 Ω resistor in the figure given below.



(c) What are active circuit elements? 2+6+2

4. (a) What do you mean by 'transient response' and 'steady state response' of a circuit?

(b) A capacitor of capacitance C is fully charged with a battery of emf V_0 and is allowed to discharge through a resistor of resistance 'R'. Derive the expression for the instantaneous voltage and current during discharge. (2+2)+6

5. (a) Let a voltage source $V = V_m \sin(\omega t)$ be applied to a RLC circuit connected in series and the corresponding current through the circuit be $I = I_m \sin(\omega t + \varphi)$. Find an expression for the total impedance of the circuit and derive the condition for resonance.

(b) Define bandwidth and half power frequency for the series resonant RLC circuit. (4+3)+3

Unit - II

6. (a) Briefly differentiate among insulators, conductors and semi-conductors.

(b) Briefly explain drift and diffusion current in connection with a semiconductor.

(c) Draw the energy band diagram of a P-N junction under reverse bias condition. 3+4+3

7. (a) Draw a neat and labelled diagram of an N-channel JFET, clearly indicating the source, drain and gate terminals.

(b) Briefly describe the phenomenon of pinch-off in connection to JFET.

(c) Is JFET a unipolar device or a bipolar device? State the reasons. 4+3+(1+2)

8. (a) Briefly compare a BJT and a FET.

(b) Describe the construction and basic operation of a depletion type MOSFET.

(c) Define 'transconductance'. 3+(3+3)+1

Group - B

Answer ***question no.* 9** and ***any four*** from the rest, taking ***two*** from each of **Unit-I** and **Unit-II**.

9. Answer ***any five*** questions : 2×5

(a) Define line regulation and load regulation.

(b) What is the reason for conduction in a Zener diode under reverse-bias condition?

(c) Define ripple-factor and percentage regulation.

(d) Define Quiescent point in a transistor.

(e) What are the factors that affect the stability of an operating point?

(f) Draw the equivalent circuit of an Op-Amp.

(g) Define input offset voltage.

(h) Briefly describe virtual short in connection with Op-Amp.

Unit - I

10. (a) Briefly explain the operation of a bridge rectifier with a neat circuit diagram and timing diagram.

(b) What is a π-type filter? Is it better than a capacitor filter? Explain. 7+(1+1+1)

11. (a) Define the different h-parameters.

(b) Using the h-parameter equivalent circuit of a transistor amplifier connected in CE mode, calculate the following :

(i) Current gain (ii) Voltage gain (iii) Output impedance. 4+6

12. (a) Define the following modes of operation of an amplifier :

(i) Class A (ii) Class AB (iii) Class C.

(b) Briefly describe class B push-pull arrangement of an amplifier. 6+4

13. (a) Explain with neat diagrams, the four types of negative feedback in amplifiers.

(b) Briefly state the advantages and disadvantages of negative feedback. 7+3

Unit - II

14. (a) Briefly explain the concept of virtual ground.

(b) Draw the frequency response of an Op-Amp.

(c) Briefly explain the working of—

(i) Summing amplifier (ii) Inverting amplifier. 3+2+(3+2)

15. (a) What is slew rate?

(b) Briefly explain the operation of an integrator.

(c) Draw the circuit diagram of a differential amplifier and explain its operation. 2+4+(1+3)

16. (a) What do you mean by an active filter?

(b) Briefly explain the operation of a high-pass filter constructed using an Op-Amp.

(c) Define cut-off frequency and draw the gain vs frequency curve of an ideal low-pass filter. 2+4+(2+2)
