Basic Electrical Engineering

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PREFACE

Basic electrical engineering is taught to first year undergraduate students in almost all the disciplines. It is a foundation course of study for all the B.Tech students. The content of this book perfectly matches with the syllabus prescribed by the ALL INDIA COUNCIL FOR TECHNICAL EDUCATION (AICTE), New Delhi and subsequently implemented by many state level universities. The Presentation of material contained in this book has been made using the rich experience gained in teaching the subject for the last ten years in different engineering colleges.

The purpose of this book is to provide a basic foundation of various concepts, principles, and practices of electrical engineering to both electrical and non-electrical engineering students. After studying this course, the students would find it easy to learn the core and applied electrical engineering subjects in higher classes and also decide all the areas of their specialization. Non electrical engineering students will benefit by understanding the basics of electrical engineering so that they are able to act independently on some simple matters related to electrical engineering and work with electrical engineers in finding solutions to inter disciplinary problems. As citizen also, all students will learn about how optimally we can use energy, safe and efficient use of electricity.

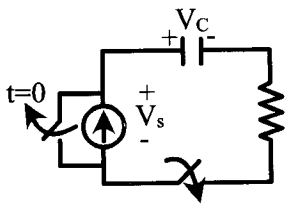
The first chapter of this book deals with basic circuit laws, theroms, methods of simplifying DC network problems and time domain analysis of RL & RC circuit.

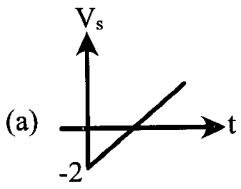
The second chapter deals with AC circuits and their steady state analysis and also included the resonant circuit, three phase balanced circuits and their applications.

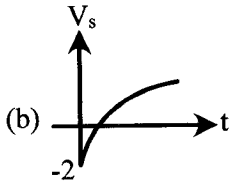
The third chapter includes detailed study of transformer, their connections, and places of use in power transmission and distribution systems.

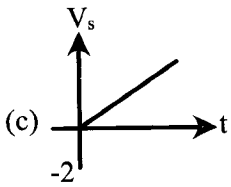
Chapter four and five contains study of both DC and AC rotating electrical machines this will provide an overview of generators used for production of electricity and motors used as drives in many domestic and industrial applications. This chapter Provides details of electricity distribution system starting from distribution sub-station to the consumer of electricity. Various protective devices for the safe use of electricity have also been explained. It also included topics such as method of power factor improvement, UPS system energy conservation, efficient and safe use of electricity.

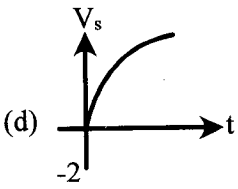
This book gives Simple explanation, plenty of examples and solved numerical problems and review questions of varied types from the essence of each chapter. I would like to express my sincere appreciation for all the team members of Spectrum publications PVT LTD. who have contributed to the publication of this book. I assure the students that once they start using this book they would simply enjoy learning, get motivated to know more, and a consequence excel in their life.



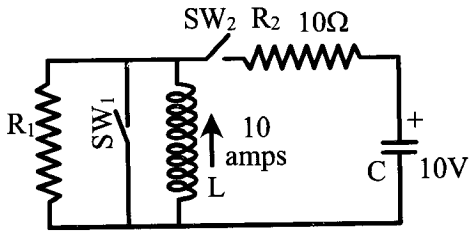






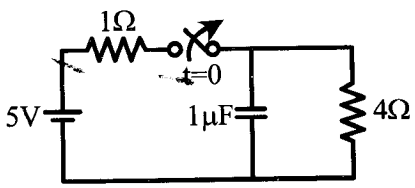


. In the circuit shown in figure. Switch SW_1 is initially CLOSED and SW_2 is OPEN. The inductor L carries a current of 10 A and the capacitor charged to 10 V with polarities as indicated. SW_2 is initially CLOSED at t=0- and SW_1 is OPENED at t = 0. The current through C and the voltage across L at t = 0+ is **[GATE'17]** ( )



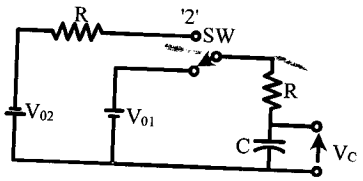
(a) 55 A, 4.5 V (b) 5.5 A, 45 V (c) 45 A, 5.5 A (d) 4.5 A, 55 V

. The switch in the circuit has been closed for a long time. It is opened at t=0. At $t = 0^+$, the current through the 1μF capacitor is **[GATE'10]** ( )



(a) 0 A (b) 1 A (c) 1.25 A (d) 5 A

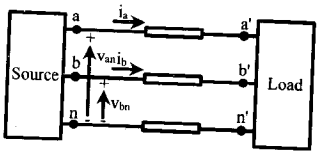
22. The switch SW shown in the circuit is kept at position '1' for a long duration. At $t = 0^-$, the switch is moved to position '2'. Assuming $|V_{02}| > |V_{01}|$, the voltage $v_C(t)$ across the capacitor is **[GATE'09]** ( )



(a) $v_c(t) = -V_{02}(1 - e^{-t/RC}) - V_{01}$ (b) $v_c(t) = V_{02}(1 - e^{-t/RC}) + V_{01}$

(c) $v_c(t) = (-V_{02} + V_{01})(1 - e^{-t/RC}) - V_{01}$ (d) $v_c(t) = (V_{02} + V_{01})(1 - e^{-t/RC}) + V_{01}$

23. A source is supplying a load through a 2-phase, 3-wire transmission system as shown in figure below. The instantaneous voltage and current in phase-a are $V_{an} = 220\sin(100\pi t)V$ and $i_{an} = 10\sin(100\pi t)A$, respectively. Similarly for phase-b, the instantaneous voltage and current are $V_{bn} = 220\cos(100\pi t)V$ and $i_{bn} = 10\cos(100\pi t)A$, respectively. **[GATE'17]**( )

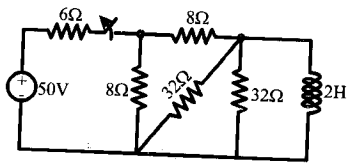


The total instantaneous power flowing from the source to the load is

(a) 2200 W (b) $2200\sin^2(100\pi t)W$

(c) 4400 W (d) $2200\sin(100\pi t)\cos(100\pi t)W$

24. The switch in the figure below was closed for a long time. It is opened at $t = 0$. The current in the inductor of 2 H for $t \geq 0$, is **[GATE'17]** ( )



(a) $2.5e^{-4t}$ (b) $5e^{-4t}$

(c) $2.5e^{-0.25t}$ (d) $5e^{-0.25t}$

25. A combination of 1 μF capacitor with an initial voltage $v_C(0) = -2v$ in series with a 100 Ω resistor is connected to a 20 mA ideal dc current source by operating both switches at $t = 0$ s as shown. Which of the following graphs shown in the options approximates the voltage v_s across the current source over the next few seconds? **[GATE'14]** ( )

28. Resistance switching is normally employed in [GATE'15] ( )
(a) All breakers (b) Bulk oil breakers
(c) Minimum oil breakers (d) Air blast circuit breakers

29. A large-size alternator is protected against over loads by providing [GATE'15] ( )
(a) Over current relays (b) Temperature sensitive relays
(c) Thermal relays (d) A combination of (A) and (B)

Answers

1. (d)	2. (d)	3. (a)	4. (a)	5. (d)
6. (d)	7. (c)	8. (d)	9. (a)	10. (a)
11. (d)	12. (a)	13.(a)	14. (c)	15.(c)
16. (c)	17. (b)	18. (d)	19. (b)	20.(a)
21. (a)	22. (d)	23.(a)	24. (a)	25. (c)
26. (d)	27. (b)	28. (d)	29. (b)	