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Question Paper Code : 91004

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fifth/Sixth/Seventh Semester

Electrical and Electronics Engineering

EE 3013 – SMPS and UPS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the advantages and disadvantages of a Cuk converter?
2. List the common performance measures of a dc-dc converter.
3. Sketch the plot between K_{bound} Vs duty cycle for a buck converter operating in CCM/DCM mode. Signify the importance of the conduction parameter K_{bound} .
4. Compare isolated and non isolated dc-dc converter.
5. State the salient features of the state space method of controller design.
6. What is an isolated dc-dc converter?
7. How to select the capacitors for UPS and filters?
8. Define transfer time and back up time of UPS.
9. State the requirements of SMPS.
10. If a person use one ceiling fan (80W), two tube lights (40W per tube light) two CFL(7W per CFL) simultaneously with UPS having 12V, 150AH battery. Calculate backup time of UPS battery.

PART B — (5 × 13 = 65 marks)

11. (a) Sketch the steady state waveforms of a buck converter in continuous conduction mode and derive the voltage and current ripple.

Or

- (b) From the fundamental principles derive the state space model of ideal non isolated buck boost converter operating in CCM mode

12. (a) For an ideal buck converter, sketch the ON and OFF duration equivalent circuits and obtain the steady state solution.

Or

- (b) Explain the need for a small signal model and hence derive the input transfer function model $[\hat{V}_o(s) / \hat{V}_g(s)]$ of a boost converter.

13. (a) Describe in detail state space averaging technique applied to buck converter system.

Or

- (b) Obtain the state space model of ideal non isolated buck boost converter operating in CCM mode.

14. (a) With real time application explain the analysis and design of PID controller for buck boost dc-dc converter.

Or

- (b) Define the terms: gain margin and phase margin. Explain about the Bode plot based analysis of buck boost converter with suitable illustration and sketches.

15. (a) Mention and explain the various types of line disturbances that are generally occurred. Also explain need of filter for PWM VSI.

Or

- (b) Explain the working principle of OFF-Line standby UPS and ON-Line UPS with block diagrams.

PART C — ($1 \times 15 = 15$ marks)

16. (a) With waveforms, explain the operating modes of Buck converter in Non-isolated mode and hence deduce the expression for boundary value of inductance to decide the operating modes between CCM and DCM.

Or

- (b) What is DCM? Draw the equivalent circuits of the buck converter in the various sub periods and the steady state inductor current and voltage. Derive the voltage and current ripple and comment on the same.
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