

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code : 81253

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Fifth/Sixth/Seventh Semester

Electrical and Electronics Engineering

EE 3013 — SMPS AND UPS

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Write the voltage conversion ratio of a Boost DC–DC converter in terms of duty cycle.
2. Differentiate between continuous conduction mode and discontinuous conduction mode.
3. List two advantages of using a half-bridge isolated DC–DC converter.
4. What are the different types of isolated DC-DC converters?
5. What is the limitation of transfer function model in DC–DC converter?
6. What is the purpose of drawing the AC equivalent circuit of a DC–DC converter?
7. What is the importance of phase margin in a DC–DC converter?
8. Why is a controller used in a Buck – Boost converter?
9. What are power line disturbances?
10. What is the function of a filter in a PWM-based Voltage Source Inverter?

PART B — ($5 \times 13 = 65$ marks)

11. (a) Discuss the principle and operation of a Buck converter with necessary circuit diagram and waveforms in continuous conduction mode.

Or

- (b) Explain the volt-second balance for the inductor and the charge balance for the capacitor in a DC–DC converter and discuss their use in steady-state analysis to determine output voltage and current relationships.

12. (a) Explain the operation of a flyback converter with a neat circuit diagram, voltage and current waveforms and derive the output voltage equation.

Or

- (b) Explain the design considerations of a Switched-Mode Power Supply with a neat diagram, highlighting the role of inductors and transformers.
13. (a) Explain the state-space averaging technique and derive the averaged state equations for Buck–Boost converter, and discuss its use in small-signal analysis.

Or

- (b) Explain the circuit averaging method and represent any DC–DC converter using its averaged model and discuss how this method is used to predict the dynamic performance of the converter.
14. (a) Explain the procedure to draw a Bode plot for any DC–DC converter and use it to analyze the converter's stability.

Or

- (b) (i) Explain the design procedure of a PI controller for any DC–DC converter. (8)
- (ii) Compare the PI and PID controllers in terms of their structure and performance. (5)
15. (a) (i) Explain the working principle of Offline UPS systems with neat diagram. (8)
- (ii) Compare Offline and Online UPS based on its advantages, disadvantages and applications. (5)

Or

- (b) Explain the working principle of a front end battery charger with neat diagram and discuss the operation of a boost charger and how it ensures efficient battery charging.

PART C — (1 × 15 = 15 marks)

16. (a) Explain how a Cuk converter can be represented as a cascade of a Boost converter followed by a Buck converter and analyze the impact of this configuration on voltage and current characteristics. Discuss the isolated version of the Cuk converter, with a neat circuit diagram and key waveforms.

Or

- (b) A Boost converter operates with a fixed input voltage and inductor. Analyze the effect of varying load on its operation and explain how changes in load current can cause a transition between Continuous Conduction Mode (CCM) and Discontinuous Conduction Mode (DCM). Derive the boundary condition that separates CCM and DCM.