Q. Code:647282

Reg. No. | | | | | | | | | | | | | |

M.E/ M. TECH.DEGREE EXAMINATIONS, MAY 2024

Second Semester

PD22202 – CONTROL SYSTEM DESIGN FOR POWER ELECTRONICS

(Regulation 2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Understand an overview on modern linear control strategies for power electronics devices.	2
CO 2	Design appropriate controllers for modern power electronics devices.	4
CO 3	Understand the concept and overview on modern nonlinear control strategies for power electronics devices.	2
CO 4	Model modern power electronic converters for industrial applications.	4

PART- A(20x2=40Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	Write the static transfer function of Buck converter.	1	2
2.	How does a SEPIC converter differ from a traditional Buck-Boost converter?	1	2
3.	What role does feedback control play in power electronics converters?	1	2
4.	Depict the switched model of boost-boost converter from its circuit model.	1	3
5.	List the three significant phases in Sliding Mode Control.	2	2
6.	Write the sliding function 'S' for Boost converter.	2	2
7.	Distinguish Variable Structure Systems (VSS) from conventional control systems.	2	4
8.	Write the Lyapunov function for the power converter to analyze the stability of its zero dynamics.	2	2
9.	When a system is said to be flat?	2	2
10.	Distinguish GPI and PID controller.	2	4
11.	In the context of control system design, what key principle does Passivity Based Control (PBC) rely on?	2	2
12.	Highlight the advantages of using SMC over traditional control methods in power converters.	2	2
13.	How does Isidori's Canonical Form contribute to achieve Feedback Linearization in control systems?	3	3
14.	Outline the key advantages of Passivity Based Control compared to other control strategies.	3	2

15.	Compare and contrast Full Order Observers and Reduced Order Observers in terms of their design complexity and performance.	3	4
16.	Elucidate the significance of Input-Output Feedback Linearization in control systems.	3	3
17.	What is the primary objective of model predictive control (MPC) in power converters?	4	2
18.	How does an AC-DC-AC converter system utilize predictive control strategy?	4	4
19.	Enumerate methods that are commonly used for fault diagnosis in power converters.	4	2
20.	Compare model predictive control and traditional control techniques in power converters.	4	4

PART- B (5x 10=50Marks)

		Marks	CO	RBT LEVEL
21. (a)	Derive the averaged switching model of Zeta converter.	**(10)**	1	3
	(OR)			
(b)	Derive the general mathematical model of CUK converter.	**(10)**	1	3
22. (a)	Design and implement sliding mode controller for Buck converter.	**(10)**	2	4
	(OR)			
(b)	Design and implement sliding mode controller for SEPIC converter.	**(10)**	2	4
23. (a)	Explain the concept of pole placement by Full State Feedback in linear feedback control. Provide a step-by-step procedure for designing a full state feedback controller for a given system.	**(10)**	2	3
	(OR)			
(b)	Explain the concept of Reduced Order Observers in control systems. How do they contribute to simplifying control design while maintaining system observability and estimation accuracy?	**(10)**	2	3
24. (a)	Design the state feedback linearized model for DC-DC buck-boost converter.	**(10)**	3	4
	(OR)			
(b)	Design a full order observer for DC-DC boost converter.	**(10)**	3	4
25. (a)	Derive the optimal solution for FCS-MPC strategy used for power converters and drives.	**(10)**	4	4
	(OR)			
(b)	Design a predictive control strategy for a three-phase Inverter.	**(10)**	4	4

PART- C (1x 10=10Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Design a high-performance controller for a DC-DC buck converter to enhance its efficiency and control accuracy. Analyze the proposed controller's impact on system stability and steady-state performance,	**(10)**	4	4

considering factors such as load variations and input voltage fluctuations.

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