IV B.Tech – I Semester
(20EE7324) ANALYSIS OF POWER ELECTRONICS CONTROLLERS

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

Pre-Requisite: Power Electronics

Course Objectives

1. To enable the students to experience in analysing and designing of various power converters.
2. It aims to familiarize the advanced PID Controllers, resonant controllers, loop-shaping methods, sliding mode control for various power converters.

Syllabus

Unit – 1: Modelling of Power Types of Models

Linearized Averaged models- Large signal and Small signal models- Switched models- Relation between various model types- Control goals in converter operation.

Unit – 2: Advanced PID controller

PID controller-Tuning methods of PID controller- Set point weighting- Integrator Windup- Controller degrees of freedom- Model based Design methods: Direct Synthesis (DS) method, Internal Model Control (IMC) method- Fractional Control System (FOS) -Design of Fractional PID controller

Unit – 3: Resonant Controller

Necessity of resonant controller- Principle of Proportional Resonant (PR) control- Design methods of PR controller- Example of PR controller design for DC-DC boost converter

Unit – 4: Loop-shaping design

Concept of Loop shaping- Robust controller design using the loop shaping methods: H∞ Control, Quantitative feedback theory (QFT).

Unit – 5: Sliding mode controller (SMC)

Nonlinear control preliminaries-Types of Uncertainty-Sliding surface design- Stability of SMC- Equivalent control concept- Integral Sliding Mode Control (ISMC) design

Course Outcomes

S. No	Course Outcomes	BTL
1.	Able to understand and analyse the different types of converter model and its usage	L1
2.	Able to design the advanced PID controller with its fractional version and resonant controller for converters	L4
3.	Able to design the resonant controller for converters	L4
4.	Able to design the robust controller for converter using the loop-shaping methods	L4
5.	Able to design controller for converter using the Sliding mode control.	L3

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P010	PO11	P012	PSO1	PSO2
CO1	3	2	2	2	3	2								
CO2	3	3	3	3	3	2								
CO3	3	3	3	3	3	2								
CO4	3	3	3	3	3	2								
CO5	3	3	3	3	3	2								

1 – Weak, 2 – Moderate and 3 – Strong

Text Books:

1. Power Electronic Converters Modeling and Control with Case Studies, S. Bacha, I. Munteanu, A.I. Bratcu, Springer- Verlag London, 2014, 1st Edition
2. PID and Predictive control of Electrical Drives and Power Converters using MATLAB/Simulink, L. Wang, S. Chai, D. Yoo, L. Gan, K. Ng, Wiley Press, 2015, 1st Edition
3. Robust Linear Control of DC-DC Converters: A Practical Approach to the Synthesis of Robust Controllers, C. Olalla, Ramon Leyva, I. Queinnec, VDM Verlag- Dr. Muller, 2010, 1st Edition
4. Sliding Mode controllers for Power Electronic Converters, A. Mehta, B. Naik, Springer Nature, 2019.

Reference Books:

1. Sliding Mode Control of Switching Power Converters: Techniques and Implementation, SC. Tan, Y-M. Lai, C.K. Tse, CRC Press, 2012, 1st Edition.
2. Control Design Techniques in Power Electronic Devices, Hebertt Sira-Ramirez, Ramon Silva-Ortigoza, Springer- Verlag London, 2006, 1st Edition.
3. Control of Power Electronic Converters and Systems, Freede Blaabjerg, Academic Press, 2018. 1 st Edition.
4. Control of Power Inverters in Renewable Energy and Smart Grid Integration, Q- C. Zhong, T. Hornik, Wiley Press, 2013, 1st Edition.