GUJARAT TECHNOLOGICAL UNIVERSITY
POWER ELECTRONICS ENGINEERING
B. E. SEMESTER: VII

Subject Name: **Power Electronics Systems Modelling**
Subject Code: **172401**

Teaching Scheme				Evaluation Scheme			
Theory	Tutorial	Practical	Total	University Exam (E)		Mid Sem Exam (Theory) (M)	Practical (Internal)
				Theory	Practical		
4	0	2	6	70	30	30	20

Sr. No	Course Content	Total Hrs.
1.	**Introduction:** • Review of Model, SISO and MIMO systems • Concept of steady state and dynamic models, normalized model • System dynamics, Integro-differential Equations, Transfer function of linear systems • State space models of linear systems, Transient response analysis, State response, transfer matrix, impulse response, response to arbitrary input, response to initial condition, solution of time invariant state equations, concept of controllability and observability	8
2.	**Steady State and AC Modelling:** • Inductor volt-second balance, capacitor charge (Amp-second) balance, small ripple approximation, Output voltage ripple estimation, examples • Steady state equivalent circuit modelling	8
3.	**AC Equivalent Circuit Modelling:** • Objectives of AC modelling, nonlinearity introduced due to switching, linearization concept and small signal model • AC modelling approach, averaging inductor and capacitor waveforms, average input current, perturbation and linearization, small signal equivalent circuit model, examples • State space averaging, example	8

	• Circuit averaging, steps of circuit averaging, perturbation, linearization, switch averaging, examples for modelling conduction and switching losses • Canonical circuit model and examples, modelling of pulse width modulator	
4.	**Converter Transfer Function:** • Major steps of engineering design process • Review of Bode plots, response of single pole and single zero, right half plane zero, quadratic pole response • Analysis of converter transfer functions, examples • Origin of right half plane zero in converters • Graphical construction of impedance like series RC circuit, series RLC resonant circuit, parallel RLC resonant circuit, voltage divider circuit Transfer function	8
5.	**Dynamic Modelling of DC-DC Converter:** • State Space modelling of DC-DC converters, buck, boost and buck-boost converter • Normalization of model with respect to frequency • Normalized DC-DC converter models	8
6.	**Modelling of Inverters:** • AC transformer modelling • Modelling of inverter with different loads • Modelling of inverter with and without transformer • Inverter output with filter • PWM inverter	8
7.	**Modelling of Electrical and Electromechanical Systems**: • Modelling of DC Motor • DC Speed control system using power electronics converter	8

Text Books:

1. Fundamentals of Power Electronics, Robert W Erickson and Dragan Maksimovik
2. Fundamentals of Power Electronics with MATLAB, Randall Shaffer

Reference Books:

1. Power Electronics Essentials and Applications, L. Umanand
2. SPICE for Power Electronics and Electric Power, Muhammad H. Rashid & Hasan M. Rashid
3. System Dynamics, K. Ogata
4. Modern Control Engineering, K. Ogata