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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EE364

Course Name: SWITCHED MODE POWER CONVERTERS (EE)

Max. Marks: 100 Duration: 3 Hours

Graph sheets will be provided

PART A

Answer all questions, each carries 5 marks. Marks

1		Draw the inductor current and voltage waveforms of a buck dc-dc converter during continuous conduction mode.	(5)
2		What is the difference between unidirectional core excitation & bidirectional core excitation related to isolated dc-dc converters? Give one example for each.	(5)
3		A fly back converter, having 100 and 50 turns in secondary & primary windings respectively, is fed from an input dc voltage of 50V. Find the duty cycle &output voltage if the MOSFET has a switching frequency of 2kHz and the on period is 0.3 ms.	(5)
4		With circuit diagram and output voltage waveform, explain single phase full bridge dc-ac inverter under square wave switching.	(5)
5		Draw the hexagon showing the possible space vectors and switching states of Space Vector Modulated three phase dc-ac inverter.	(5)
6		With waveforms, describe programmed harmonic elimination in single phase dc-ac inverter.	(5)
7		Obtain an expression for current through a simple un-damped series resonant circuit fed with a dc voltage, V, assuming initial capacitor voltage and initial inductor current as zero.	(5)
8		Sketch the two types of circuit configurations used in ZCS technique.	(5)

PART B

Answer any two full questions, each carries10 marks.

9	a)	Draw the circuit diagram and waveforms of inductor voltage & current of a step-up dc-dc converter for continuous conduction mode. Derive an expression for output voltage.	(5)
	b)	Deduce the expressions for filter inductance and capacitance in a step-up dc-dc converter.	(5)
10	a)	In a dc-dc buck regulator the input voltage, Vs=12V.The average output voltage Vo=5V at R= 500Ω and peak to peak output voltage ripple is 20mV. The switching frequency is 25 kHz. If peak to peak ripple current of inductor is limited to 0.8A. Calculate (i) Duty cycle (ii) Filter inductance. (iii) Filter	(5)

Capacitance. Assume CCM operation.

b) For a Ćuk dc-dc converter operating under CCM, draw the circuit diagram and current & voltage waveforms of indcutors. Also derive an expression for output voltage in terms of input voltage and duty cycle. (5)

11 a) Explain uni-polar PWM switching signal generation for controlling full bridge dc-dc converter with waveforms. (5)

b) Show that average output dc voltage of a full bridge dc-dc converter with uni-polar switching, can be controlled by varying amplitude of reference signal. (5)

PART C

Answer any two full questions, each carries 10 marks.

12 Describe the operation of a push-pull dc-dc converter with waveforms. Deriving an expression for input-output voltage relation, show that push-pull dc-dc converter is a buck derived topology. (10)

13 a) If tertiary (demagnetising) and primary winding turns of a practical forward dc-dc converter are N_3 and N_1 respectively, show that maximum value of duty cycle in practical forward dc-dc converter is $D_{max} = \frac{1}{1+N_3/N_1}$ (5)

b) Find the switching utilisation factor for single phase full bridge inverter with (i) square wave switching and (ii) with sine PWM. (5)

14 With required waveforms, explain generation of sine PWM signals for controlling 3-phase bridge dc-ac inverter. Also obtain any one output line voltage waveform. (10)

PART D

Answer any two full questions, each carries 10 marks.

15 Derive expressions for switching times of possible vectors out of a switching time period in any of the sectors to obtain reference vector in Space Vector Modulation Technique. (10)

16 a) With waveforms, explain hysteresis current control for single phase dc-ac inverter. (5)

b) Illustrate how a ZVS configuration reduces switching loss using any one dc-dc converter showing switch current and switch voltage waveforms. (5)

17 Explain series load resonant converter with resonant inductor current and capacitor voltage waveforms operating under the condition when switching frequency is less than half of resonant frequency ($f_s < \frac{1}{2} f_o$). (10)

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