

Reg No.: _____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: EE364

Course Name: SWITCHED MODE POWER CONVERTERS

Max. Marks: 100

Duration: 3 Hours

Graph Sheets will be provided

PART A

Answer all questions, each carries 5 marks.

Marks

- | | | |
|---|---|-----|
| 1 | Obtain the input-output voltage and current relation as a function of duty ratio for a Boost dc-dc converter in continuous conduction mode. | (5) |
| 2 | What is linear power supply? Mention the drawbacks of linear power supply. | (5) |
| 3 | Explain the basic concept of a push pull converter derived from buck converter. | (5) |
| 4 | Define the terms amplitude modulation ratio and frequency modulation ratio in a PWM switching scheme. | (5) |
| 5 | Compare PWM technique and space vector modulation technique. | (5) |
| 6 | Explain the concept of tolerance band current control technique. | (5) |
| 7 | What is meant by resonant converters? How are they useful in SMPC applications? | (5) |
| 8 | Briefly explain the characteristics of an undamped series resonant circuit. | (5) |

PART B

Answer any two full questions, each carries 10 marks.

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|----|---|-----|
| 9 | a) For an ideal buck converter, derive the value for L_{crit} in terms of duty cycle, switching frequency, and load at the boundary of discontinuous conduction mode (DCM) and continuous conduction mode (CCM). | (5) |
| | b) In a step up converter, consider all components to be ideal. Let V_d be 8-16 V, $V_o = 24V$, $f_s = 20kHz$, and $C = 470\mu F$. Calculate L_{min} that will keep the converter operating in continuous conduction mode if $P_o \geq 5W$. | (5) |
| 10 | a) With help of neat sketches derive the expression for the voltage ripple in an ideal buck-boost converter. | (5) |

- b) In a Cuk converter shown in Figure 1, operating at 50 kHz, $L_1 = L_2 = 1$ mH and $C_1 = 5$ μ F. The capacitor is sufficiently large to yield an essentially constant output voltage. Here, $V_d = 10$ V and the output V_o is regulated to be constant at 5V. It is supplying 5 W to a load. Assume ideal conditions. Calculate the RMS current flowing through the capacitor C_1 (5)

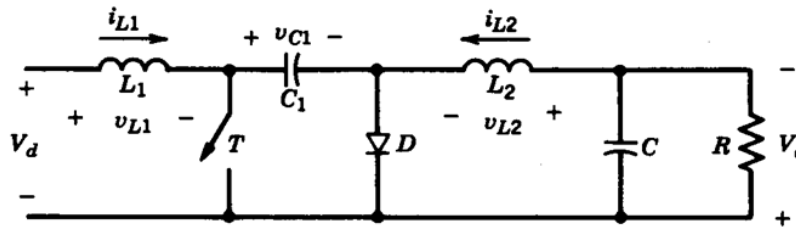


Figure 1

- 11 a) With help of neat sketches explain the operation of full bridge DC-DC converter with bipolar voltage switching scheme. (6)
- b) Write a short note on the electrical isolation in DC-DC converters. (4)

PART C

Answer any two full questions, each carries 10 marks.

- 12 a) With help of neat sketches explain the operation of a flyback converter (6)
- b) A forward converter with a demagnetising winding is designed to operate with a maximum duty ratio D_{max} of 0.7. Calculate the voltage rating of the switch in terms of input voltage V_d . (4)
- 13 a) With help of relevant sketches explain the operation of a full bridge DC power supply. (5)
- b) Explain the control of a single phase full bridge inverter with PWM unipolar voltage switching scheme. (5)
- 14 a) How the output voltage of a single phase inverter is controlled using voltage cancellation technique? Explain. (5)
- b) Explain the operation of a three phase inverter with square wave switching scheme. (5)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Explain the concept of space vector and space vector modulation technique. (5)
- b) Explain the concept of programmed harmonic elimination switching scheme to (5)

control the inverter output.

- 16 a) Write a short note on the current mode control of inverters (3)
- b) Explain the operation of a ZCS resonant converter with necessary figures and circuit diagram. (7)
- 17 a) With help of neat circuit diagram and relevant waveforms, discuss the operation of series loaded resonant dc-dc converter in discontinuous current conduction mode. (7)
- b) Compare zero voltage switching (ZVS) and zero current switching(ZCS) (3)