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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2018

Branch: Electrical & Electronics Engineering
Stream: Power Control and Drives
01EE6501: POWER CONVERTER CIRCUITS

Answer any two full questions from each part
Limit answers to the required points.

Max. Marks: 60

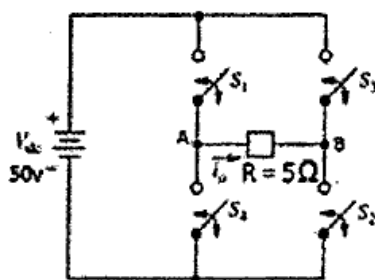
Duration: 3 hours

PART - A

1. a) Draw and explain voltage, current and power wave form of a practical switch. (4)

b) An inverter is shown with four switches. Each switch is considered as non ideal, with a forward characteristics given by $V_f = 1.6 + 0.1i_o$ V. The repetitive switching frequency is 500Hz. S1 and S4 are turned on at $t=0$ and turned off at $t=0.6\text{ms}$. S2 and S3 are turned on at $t=1\text{ms}$ and turned off at $t=1.6\text{ms}$. Determine:

- i) the maximum instantaneous power loss in any one switch
ii) the average power loss in it
iii) the maximum instantaneous power output from the converter and its average efficiency. (5)



2. a) Explain displacement factor and distortion factor (3)
b) Express the input current in Fourier series and determine THD and input power factor of a single phase half wave diode rectifier (6)

3. a) Explain the operation of the current bidirectional and voltage bidirectional two quadrant switches. (4)
b) Explain line voltage distortion at the input to the single phase diode bridge rectifier. (5)

PART – B

- 4 Describe the working of a single phase full converter both in the rectifier and inverter mode with RLE load, Illustrate with waveforms for source voltage, load voltage, source current and load current. Assume continuous conduction. (9)
- 5 Explain the operation of a Boost Converter with circuit diagram and relevant waveform. Derive the expression for L and C. (9)
- 6 a) Discuss the effect of source inductance in a 1Φ fully controlled converter. Draw the relevant waveforms. <http://www.ktuonline.com> (5)
b) A buck converter has an input voltage, $V_s=15$ V. The required average output voltage $V_a= 5$ V and the peak to peak output ripple voltage is 10 mV. The switching frequency is 20 KHz. The peak to peak ripple current of inductor is limited to 0.5 A. Determine i) the duty cycle ii) the filter inductance iii) the filter capacitance iv) the critical values of L and C (4)

PART – C

- 7 a) Draw the circuit diagram and explain the operation of a forward converter for continuous conduction mode. Give relevant waveforms. Derive the voltage transfer ratio. (8)
b) Explain the advantages of flyback converter. (4)
- 8 Explain the operation of 3 phase inverter with 180° conduction with circuit diagram. Draw the timing diagrams of the switches and the resulting phase and line voltages. (12)
- 9 a) Describe a single phase capacitor commutated current source inverter with purely resistive load. (6)
b) Explain the operation of a push-pull dc-dc converter with circuit diagram and relevant waveforms. (6)