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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, MAY 2018

Electrical and Electronics Engineering

(Power Control and Drives)

01EE6502: Design Principles of Power Converters

Max. Marks: 60 Duration: 3 Hours

*Answer **any two questions** from each part.*

PART A

1. Design an inductor for buck converter configuration with the following specifications:
Output voltage, $V_o = 3.3V$
Output current, $I_o = 5A$
Switching frequency, $f_s = 20$ kHz
Input voltage, $V_i = 10V \pm 10\%$
Diode voltage drop, $V_d = 1V$
Operating flux density, $B_{ac}=0.05T$
Window utilization factor, Ku=0.29
Current density, J=433 A/cm^2 9 marks

2. A dc chopper has a MOSFET switch that dissipates 40W and load free wheel diode that dissipates 20W. Both devices are mounted on a common heat sink. The MOSFET has junction to case thermal resistance of 0.7K/W and case to heat sink thermal resistance of 0.5K/W. The diode has junction to case thermal resistance of 0.8K/W and case to heat sink thermal resistance of 0.6K/W.
   a) Determine the maximum heat sink thermal resistance that maintains both junction temperatures below 90°C in an ambient of 30°C. (6 marks)
   b) Semiconductor lifetime approximately doubles for every 10°C decrease in junction temperature. If the heat sink in the previous case is fan cooled, estimate the lifetime improvement if the heat sink thermal impedance is halved with fan cooling. (3 marks)

3.	a)	Explain what makes the design of fly back transformer different from other transformers. Explain its design using area-product approach	5marks
	b)	Explain different types of heat transfer methods	4marks

PART B

4.		What is the effect of parasitic inductance in power electronic module? Explain the techniques to reduce parasitic inductance	9 marks
5.		Draw a 3 phase inverter driver circuit using IR 2110. With necessary connection diagram, explain the necessity of each element connected external to the driver IC	9 marks
6.	a)	Explain the working of any one TRIAC driver circuit with relevant diagrams.	5 marks
	b)	Explain the effect of Free wheel diode recovery surge in power electronic modules due to parasitic inductance	4 marks

PART C

7.		Explain over current protection using de-saturation scheme	12 marks
8.		Explain the common mode noise of EMI. Draw and explain the working of a common mode filter	12 marks
9.	a)	Draw the diagram showing an integrated inverter system	6 marks
	b)	Explain common mode filters, to suppress electromagnetic interference	6 marks