Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2015

SUBJECT: MODERN POWER CONVERTERS [ELE 455]

REVISED CREDIT SYSTEM

Time: 3 Hours 28 NOVEMBER 2015 MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitably assumed.

1A. Design a buck converter to obtain an output voltage of 25 V from an input of 50 V. The switching frequency is 20 kHz and the output power is 125 W. Determine the duty ratio, value of inductance to limit the peak inductor current to 6.25 A and value of capacitor to limit the output voltage ripple to 0.5%. Take the drop across the switch and the diode to be 0.3 V and 0.5 V respectively. **(06)**

1B. For the circuit shown in Fig. Q1B, determine the voltage conversion ratio Vo/Vs when both the switches are operated synchronously i.e. each is in position 1 for 0<t<DTs and in position 2 for DTs<t<Ts. **(04)**

2A. SEPIC has the following parameters: V_s= 12V ± 5%, V_o = 12 V, I_o = 1 A. The inductor current and capacitor voltage ripples should be less than 3%. Design the circuit for mentioned specifications assuming circuit components to be ideal and employ 100 kHz of switching frequency for the design. **(05)**

2B. With the help of neat circuit schematic and relevant waveforms, explain the working principle of buck-boost converter. Assuming continuous mode of operation, determine the selection of inductor and the capacitor for a particular ripple condition. Hence, obtain an expression for output voltage. **(05)**

3A. A flyback converter has the following parameters: V_s = 24 V, N_1/N_2 = 3, L_m = 500 µH, R = 5Ω, C = 200 µF, f_s = 40 kHz and V_o = 5 V. Determine duty ratio, maximum and minimum current in L_m, output voltage ripple. Now, if the load resistance is increased from 5Ω to 20Ω, with all other parameters remaining unchanged, determine the output voltage. **(06)**

3B. Explain the role of tertiary winding in case of Forward converter. Hence derive an expression for the duty ratio D which ensures the total demagnetization of the core before the start of next switching cycle. **(04)**

4A. A zero current switching dc-dc converter has the following specifications: P_o= 30W, V_o= 15V, Z_o=2.5 Ω, C_r = 0.02µF, the time between diode turn-off and the switch turn-off is 4 µsec. Find the input voltage and the switching frequency for suitable implementations. **(05)**

4B. In a SLR dc-dc converter, V_s = 100 V, L_r = 75 µH, C_r = 0.04 µF, f_s = 100 kHz, R_L = 10 Ω. a) Determine the output voltage V_o. b) If the source voltage now varies over ±5%, find the range of switching frequency necessary to regulate the output voltage. **(05)**

5A. Using state-space averaging technique, develop small signal transfer function $\frac{\tilde{v}_o(s)}{\tilde{d}(s)}$ for a buck converter. Assume the circuit components to be ideal. **(06)**

5B. What do you mean by voltage feedforward control? With suitable plots, explain how feedforward property can be incorporated using current control technique. **(04)**

6A. Make a technical comparison between linear power supplies and switched mode power supplies. **(03)**

6B. With suitable block schematic, explain the working of online UPS with a mention of practical application of the same. **(03)**

6C. Discuss briefly the steps involved in design of an inductor for switched mode applications. **(04)**

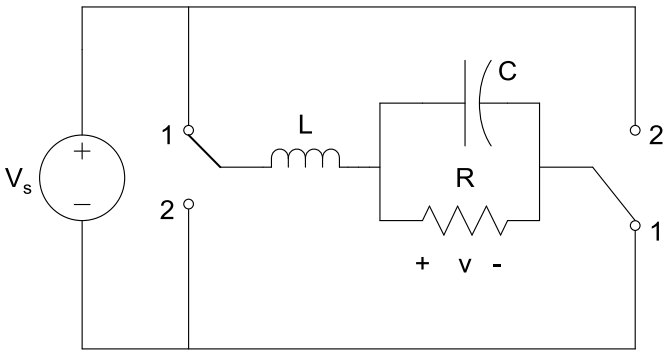

Fig. Q1B