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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Sixth Semester, B.E. – Electrical and Electronics Engineering

Semester End Examination; June/July - 2015

Advanced Power Electronics

Time: 3 hrs *Max. Marks: 100*

Note: *Answer any **FIVE** full questions, selecting atleast **TWO** full questions from **each part**.*

PART – A

1. a. What are the different topologies of dc-dc converter systems? Draw the equivalent circuits in each case. 6

   b. Explain the operation of a buck-boost converter with relevant equivalent circuits for the switch states and wave diagrams. 6

   c. The inductance in a buck-boost converter operating at 20 kHz is 0.05 mH. The input voltage is 15 V and the capacitor is sufficiently large. Calculate the duty ratio if the output voltage is to be regulated at 10 V when supplying a load of 10 W. 8

2. a. Explain the operation of full bridge dc – dc converter with bipolar voltage switching. 8

   b. Explain the operation of Cuk converter. 6

   c. In a Cuk converter operating at 50 kHz, $L_1 = L_2 = 1$ mH and $C_1 = 5\mu F$. The output capacitor is sufficiently large to keep output voltage constant. The converter is fed at 10 V and the output voltage is regulated to be constant at 5 V when supplying a load of 5 W. Assuming continuous current conduction mode, calculate the percentage errors in assuming constant voltage across C_1 or in assuming constant inductor currents. 6

3. a. What are voltage source inverters? Explain the basic concepts used in the three VSI categories. 6

   b. Explain the operation of a single – phase full – bridge inverter with the help of necessary circuit diagram and waveforms. 6

   c. A single-phase full-bridge inverter operating at 400 Hz with an input dc voltage of 220 V supplies an RLC load with R = 5 Ω, L = 10 mH, and C = 26 μF. Determine the rms load current and the TDH of the load current considering only up to 5^{th} harmonic. 8

4. a. Explain the operation square wave inverter. 6

   b. Discuss the effect of blanking time on the output voltage of a single-phase full-bridge inverter. 6

   c. Explain the operation of a full bridge inverter using PWM with unipolar voltage switching with relevant diagrams. 8

Contd… 2

PART - B

5. a. What are the limitations of switch-mode converters? How are these limitations minimized in resonant converters? Give the classification of resonant converters. 6

   b. Explain the operation of any one ZCS resonant–switch converter configurations with the necessary diagrams. 8

   c. A thyristor based resonant RLC inverter has R = 1 Ω, L = 0.1 mH, and C = 10 μF. Find the maximum switching frequency for non-overlap operation if the turn-off time of the thyristor is 12 μs. 6

6. a. Explain the operation of a fly back converter with the help of circuit diagram and waveforms. 6

   b. Explain the operation of an actively clamped resonant inverter. 6

   c. Explain the basic operation of a resonant-dc-link inverter with zero-voltage switching. 8

7. a. Explain the two basic configurations of an UPS system. 6

   b. Give the basic configurations of switched-mode dc power supplies. 6

   c. The dc output voltage of a dc push-pull converter is 24 V at a resistive load of 0.4 Ω. The on-state voltages of transistor and diodes are 1.2 V and 0.7 V respectively. The primary to secondary turn's ratio of the transformer is 2. Determine the average input current, and the efficiency. Assume ideal transformer and neglect input and output ripple currents. 8

8. a. What are the problems of the transformer core? How can these be minimized? 4

   b. Explain the procedure the single-pass method of designing a transformer, with flow chart. 8

   c. Describe the algorithmic steps involved in the single-pass algorithm for the design of inductors. 8

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