Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SEVENTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION- NOV/DEC 2016
SUBJECT: POWER ELECTRONICS (ECE - 403)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Full wave rectifier with centre tap transformer having turns ratio 5:1 is connected to an AC supply of 100V. Draw the circuit diagram and calculate the output power delivered to 5Ω load for a firing angle of 45^O. Sketch the waveforms across the any one SCR and Load.

1B. With help of the two-transistor model of SCR derive the expression for anode current and explain latching.

1C. Explain the construction of power MOSFET

(5+3+2)

2A. Identify the circuit shown in Fig. Q 2A. What is the main difference between this converter and other dc-dc converter topologies? Derive the output voltage expression for this converter and draw the current waveform in C_1 for large inductance.

2B. An inductor is energized as in the circuit of Figure Q 2B. The circuit has L = 10 mH and V_{CC} = 14 V. (a) Determine the peak inductor current and required on time of the switch such that the peak energy stored in the inductor is 1.2J. (b) Sketch the waveforms for the current through source and inductor

2C. Explain with the help of circuit diagram, the operation and use of snubbers

(5+3+2)

3A. (a) Which of the following statements belongs to half controlled and fully controlled rectifiers? If any statement belongs to both the rectifiers, write under both.

i) It has both diodes and SCRs
ii) One quadrant converter
iii) Output dc voltage can be controlled
iv) Is six pulse converter
v) Output voltage has wide controllability

(b) For the circuit shown in Fig. Q 3A assume arbitrary firing angle. i) Draw the load current waveform. ii) Draw the voltage waveform across switch.

3B. In a buck-boost converter inductor current increases linearly from 1A to 2A in 50μs and returns back linearly to 1A in next 25μs. i) If the input source voltage is 20V, obtain the output voltage. ii) Calculate the average inductor current.

3C. Derive the necessary expressions to connect two full converters in parallel in dual converters.

(5+3+2)

4A. With the help of circuit diagram, explain the working of a square-wave inverter. Along with the waveforms, derive the expression for the output current considering inductive load.

4B. The push-pull converter shown in Fig. Q 4B, has the following parameters: V_s = 50 V, N_p/N_s = 2, L_x = 60μH, C = 39μF, R = 8Ω, f = 150 kHz, and D = 0.35. Determine (a) the output voltage, (b) the maximum and minimum inductor currents, and (c) the output voltage ripple.

4C. Differentiate soft switching and hard switching. Also explain how soft switching is achieved.

(5+3+2)

5A. Draw a half bridge inverter configuration that can produce three phase AC voltages and explain its working. For 180^0 conduction mode draw the line and phase voltages for a star connected resistive load.

5B. The forward converter shown in Fig. Q 5B has parameters V_s = 100V, $N_1/N_2 = N_1/N_3 = 1$, L_m = 1mH, L_x = 70µH, R = 20Ω, C = 33µF, and D = 0.35, and the switching frequency is 150kHz. Determine (a) the output voltage and output voltage ripple (b) the peak current in L_m in the transformer model and (c) the peak current in the switch.

5C. Draw the circuit diagram of ideal transformer model and approximate transformer model that is used in the DC power supplies. Explain the approximations assumed in order to arrive at the approximate model.

(5+3+2)

6A. Define total harmonic distortion. What is the need for PWM wave in an inverter? With the help of switching scheme and waveforms, explain the unipolar switching scheme for PWM generation.

6B. List various sources of power line disturbances. Explain its effect on sensitive equipment.

6C. Explain the two major benefits of SMPS.

(5+3+2)

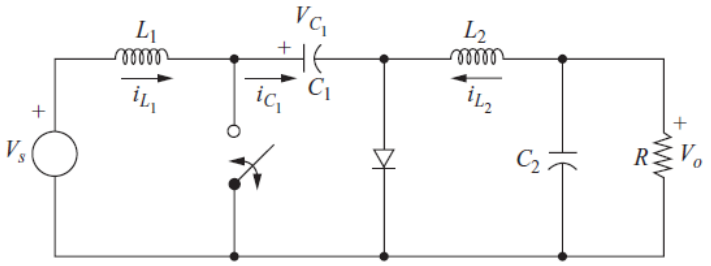

Fig Q2A

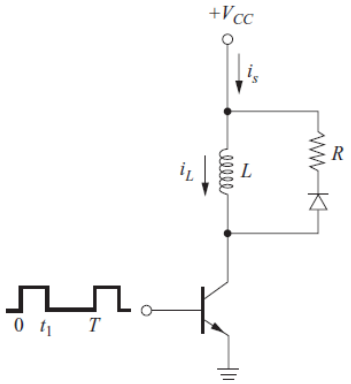

Fig Q 2B

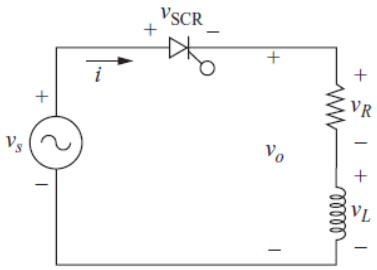

Fig. Q 3A

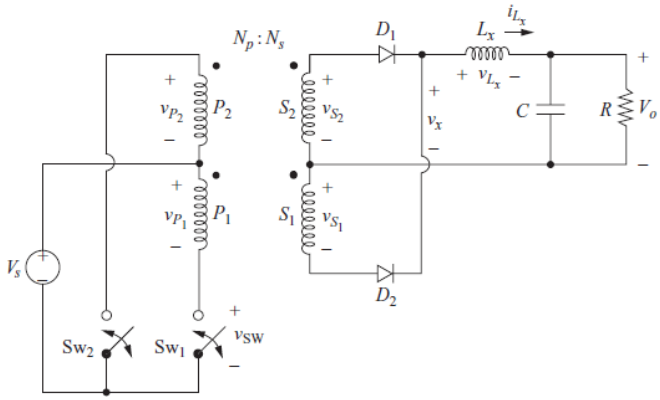

Fig Q4B

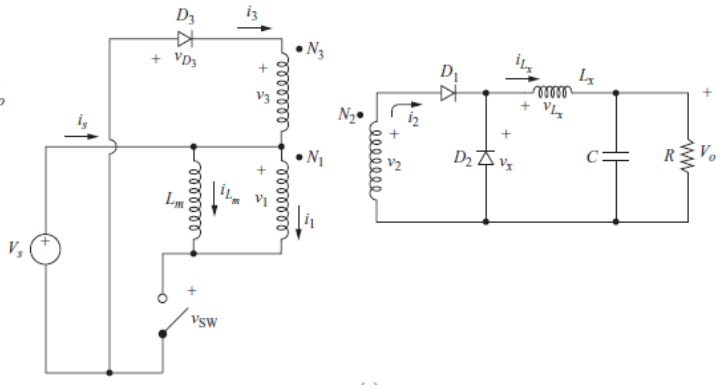

Fig Q5B