Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, JUNE 2018

SUBJECT: POWER ELECTRONICS [ELE 3201]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 13 June 2018** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. Define latching and holding currents as applicable to an SCR. Show these currents on its static I-V characteristics. ***(03)***

1B. With the help of the equivalent circuit for IGBT, discuss how latch up occurs in IGBT. What modification is required in device construction to avoid latch up? ***(03)***

1C. Draw a neat circuit for forced current commutation of an SCR. Hence, plot the waveforms for voltage across the capacitor, voltage across the SCR and voltage across the load. ***(04)***

2A. A three phase full converter bridge is connected to supply voltage of 400 V(line-line) and a frequency of 50 Hz. The source inductance is 4 mH. The load current on dc side is constant at 20 A. If the load consists of dc source of internal emf 400 V with internal resistance of 1 Ω, then calculate delay angle. ***(02)***

2B. A controlled half-wave rectifier has an ac input of 120 V rms at 60 Hz, R = 2 Ω, L = 20 mH and V_{dc} = 100 V. The delay angle is 45°. Determine an expression for the output current and hence find the rms value of the current. ***(04)***

2C. A controlled single phase bridge rectifier has 20 Ω resistive load and has a 120 V rms, 60 Hz ac source. The delay angle is 45°. Determine average load current, rms load current and the input power factor. ***(04)***

3A. A single phase to single phase Cycloconverter is delivering power to a resistive load. The frequency ratio fo/fs=1/3. The firing delay angle α for all the thyristors are the same. Sketch the output voltage waveform in synchronization with input voltage for α=45°. ***(02)***

3B. A buck converter has the following parameters: V_s = 15 V, D = 0.6, L = 10 μH, C = 50 μF and R = 5 Ω. The switching frequency is 150 kHz. Determine output voltage, maximum and minimum inductor currents. ***(03)***

3C. With the help of neat circuit schematic and triggering sequence, plot any two phase voltage waveforms and corresponding line voltage waveform for a three phase square wave bridge inverter when conduction angle of each device is 180°. ***(05)***

4A. Discuss the terms (i) Time ratio control (ii) Current limit control ***(02)***

4B. With the help of circuit schematic and relevant waveforms, explain unipolar switching scheme as applied to a full bridge inverter. Hence, plot the harmonic spectrum. ***(04)***

4C. Discuss space vector pulse width modulation (SVPWM) technique with respect to a 3 pole voltage source inverter. Mention use of null states in SVPWM technique. ***(04)***

5A. With a neat circuit schematic, explain the working of a single phase full bridge square wave inverter. Hence, plot the output voltage waveform in synchronization with the switching scheme. Also, draw the harmonic spectrum. ***(05)***

5B. With the help of neat circuit schematic, draw the voltage across the resonant capacitor and the current through the resonant inductor for a zero voltage switched buck converter. ***(05)***