MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, JUNE 2019

SUBJECT: POWER ELECTRONICS [ELE 3201]
REVISED CREDIT SYSTEM

Time: 3 Hours   **Date: 10 June 2019**   **Max. Marks: 50**

Instructions to Candidates:
- ❖ Answer **ALL** the questions.
- ❖ Missing data may be suitably assumed.

1A.	Sketch the safe operating area of power MOSFET clearly indicating all the operating limits.	*(02)*
1B.	Draw a neat circuit for forced voltage commutation of an SCR. Hence, plot the waveforms for voltage across the capacitor, voltage across the SCR and voltage across the load.	*(04)*
1C.	With the help of a neat sketch of Triac`s structure, explain its working in first quadrant when turned on with positive gate current.	*(04)*
2A.	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)*
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 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.	*(04)*
3B.	A boost converter has an input of 5 V and an output of 25 W at 15 V. The minimum inductor current must be no less than 50 percent of the average. The output voltage ripple must be less than 1 percent. The switching frequency is 300 kHz. Determine the duty ratio, inductor and capacitor values.	*(04)*
3C.	Discuss the differences between voltage source inverters and current source inverters	*(02)*
4A.	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)*

4B. 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)**

5A. Discuss how unipolar switching technique can be applied to a single phase full bridge inverter. Support your answer with relevant waveforms **(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)**