Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH. (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2024

POWER ELECTRONICS [ELE 3251]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 04 MAY 2024** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Draw the three-phase AC waveforms strictly using the uploaded sine graph.

1A. An SCR is connected in series with a 10V source and an inductance of 10mH. Evaluate the minimum pulse width of the gating signal to be applied across the SCR if it has to be in continuous conduction. The device has a latching current of 10mA. ***(03)***

1B. Explain the different types of losses in the MOSFET in a circuit. ***(02)***

1C. A 100V 60Hz single-phase AC supply feeds a load with 10Ω resistance and 20mH inductance through a single-phase full wave-controlled converter. The firing angle is 45°. Determine its average load voltage and input power factor. Analyze the voltage waveform across any one power semiconductor device in the circuit. ***(05)***

2A. Analyze the working of a three-phase fully controlled rectifier feeding an RL load with a firing angle of 45 degrees. Draw the circuit diagram and the waveforms of load voltage, load current. Derive the expression of the average load voltage. ***(04)***

2B. Analyse the working of Matrix Converter with circuit diagrams and relevant waveforms. ***(03)***

2C. Analyse the working of a single phase fully controlled rectifier feeding an RLE load with continuous current. The firing angle is 30 degrees. Draw the circuit diagram and load voltage waveform. Indicate the conducting devices in the waveform. ***(03)***

3A. A power supply application requires a DC-DC converter with an output voltage level of 5 V and an input voltage of 3 to 3.3V. The output current is 1A. Design a suitable DC-to-DC converter to interface the input to the output. Choose a switching frequency of 10kHz and a voltage ripple equal to 0.5%. ***(05)***

3B. With neat circuit diagram and relevant waveforms analyze the working of a buck-boost converter. ***(03)***

3C. A battery feeds a DC motor used in a vehicle. Suggest a suitable power electronic circuit to make the system efficient, effective, flexible, and reliable. Draw its circuit diagram and justify the choice made. ***(02)***

4A. With a neat circuit diagram, analyze the working of a high-frequency isolated full bridge dc to dc converter. Explain the need for isolation and draw the waveforms of load voltage and source current. ***(05)***

4B. Suggest the SPWM inverter that would produce a voltage with low THD. Explain the SPWM generation scheme and draw the load voltage harmonic spectra. ***(03)***

4C. With a suitable explanation, compare the topologies of the Current Source Inverter and Voltage Source Inverter and list their applications. ***(02)***

5A. Design a bipolar PWM full bridge inverter which will produce a fundamental 230V rms 50Hz output from a 300V dc source. The load is a series R-L combination with R=10 Ω and L=25mH. Select the switching frequency such that the current THD is less than 5%.Consider only the dominant harmonic and assume the amplitude of the dominant harmonic voltage to be 80% of the dc input supply. ***(04)***

5B. A 220V, 1000 rpm, 50 A separately excited dc motor has an armature resistance of 0.2 ohms.It is fed from a single phase full converter with an ac source voltage of 230V, 50Hz. Assuming continuous conduction mode, compute firing angle for rated motor torque at 400rpm. ***(04)***

5C. A buck converter needs to improve its efficiency. It was found that the drop was due to its switching losses. Suggest a method to reduce the switching losses ***(02)***