Name: Enrolment No:	

UPES
End Semester Examination, December 2023

Course: Power Electronics and Drives   Semester: I
Program: M. Tech (E-Mobility)   Code: MEEM 7004
Time: 03 hrs.   Max. Marks: 100
Instructions: All section are compulsory
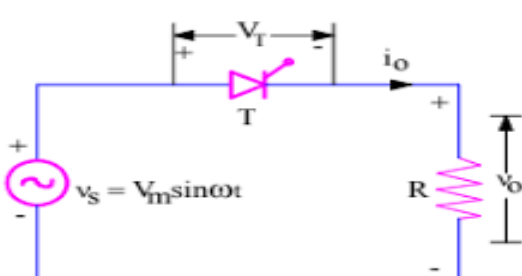
SECTION A (5Q × 4M = 20 Marks)

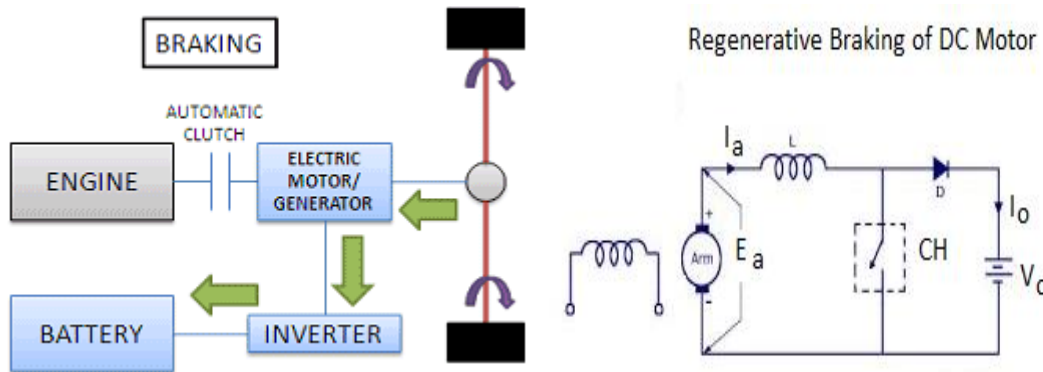| S. No.		Marks	CO
Q 1	What is the difference between power diode and signal diode?	4	CO1
Q 2	Define latching current and holding current in the thyristor.	4	CO1
Q 3	What is DC chopper? List out different application of the chopper.	4	CO2
Q 4	Explain briefly different methods to switch ON the SCR.	4	CO2
Q 5	Explain the speed control methods (armature control and field control) for a DC motor.	4	CO3

SECTION B (4Q × 10M = 40 Marks)

Q 6	Explain the operation of 3-φ bridge inverter for 180-degree mode of operation with aid of relevant phase and line voltage waveforms.	10	CO3
Q 7	What is meant by TRC? Explain with proper marking how TRC method is used for controlling the output voltage in choppers.	10	CO3
Q 8	Draw and discuss class 'C' commutation circuit along with neat schematic and relevant waveforms. What is meant by commutation? List out different types of commutation circuit.	10	CO4
Q 9	Describe the working of half wave phase controlled converter with RL load and freewheeling diode and derive the expressions for average output voltage and RMS output voltage. **OR** A single phase 220 V, 1.1 kW heater is connected across single phase, 220 V, 50 Hz supply through an SCR. For firing angle delays of 45° and 90°, calculate the power absorbed in the heater element. Consider below circuit for analysis. 	10	CO4

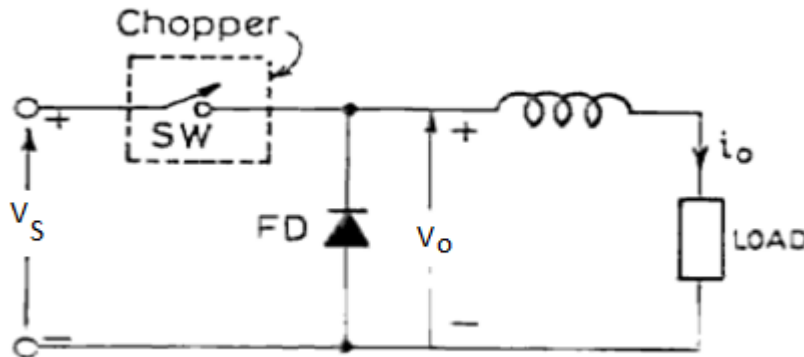|	SECTION-C (2Q × 20M = 40 Marks)		
Q 10	Discuss the principle of chopper circuit. Explain step-up and step-down chopper circuit also elucidate its working with neat sketch. Considering the input voltage, input current, output voltage and output current waveforms. Design a regenerative braking circuit using step-up chopper used in mild hybrid electric vehicle system is represented with below figure also explain its characteristics with neat sketch. 	20	CO5
Q 11	Design and describe the working of a single-phase one-pulse SCR controlled rectifier with RLE load through the neat circuit and appropriate waveforms of supply voltage, load voltage, load current and voltage across the SCR. Hence derive expression for the load current in terms of supply voltage, load impedance, firing angle, load voltage E etc. **OR** For the above figure, which is DC to DC converter, derive expression for the following variables as functions of Vs, R, and duty cycle α in case load is purely resistive. (a) Average output voltage and current (b) Output current at the instant of commutation (c) Average and RMS freewheeling diode currents (d) RMS value of the output voltage (e) RMS and average thyristor currents	20 20	CO4