UPES
End Semester Examination, December 2024

Course: Power electronics & drives   Semester: VII
Program: B.Tech. Mechatronics Engineering   Time : 03 hrs.
Course Code: ECEG 4035   Max. Marks: 100

Instructions: All questions are compulsory, internal choices are given within the sections.

SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Draw the structure, symbol and V-I characteristic of a thyristor.	4	CO1
Q.2	What is forward voltage triggering of an SCR.	4	CO2
Q.3	Draw the circuit of a Class A chopper, including the direction of current and voltage in relation to the load.	4	CO1
Q.4	Brief the significance of latching current and holding current in keeping a thyristor in its conductive state.	4	CO2
Q.5	Draw the circuit diagram to obtain the static V-I characteristic of IGBT. Also sketch the V-I characteristic of an IGBT.	4	CO1
SECTION B (4Qx10M= 40 Marks)			
Q.6	Derive the expression for the average output voltage of (a) Single phase semi-converter (b) Single phase full converter **OR** Describe the working of a single-phase full converter in the rectifier mode with inductive load. Illustrate your answer with waveforms for sources voltage, output voltage, output current, source current, current through and voltage across one thyristor. Assume continuous conduction.	10	CO3
Q.7	Explain the concepts of delay time, rise time, and spread time in the turn-on process of a thyristor, along with clear waveforms to illustrate each parameter.	10	CO2
Q.8	A first quadrant chopper is having a supply voltage of 200-volt DC and operating at a frequency of 1kHz. Find out (a) Duty cycle (b) Average load voltage (c) The rms load voltage if the on time of the chopper is 500 micro-seconds.	10	CO3
Q.9	A single-phase fully controlled bridge rectifier with a free-wheeling diode is fed from a 230V, 50 Hz AC supply. The load is highly inductive, with a resistance of 10 ohms. If the firing angle is set to 60 degrees, calculate the average load voltage and current. Also, sketch the supply	10	CO3

	current waveform, considering the effect of the free-wheeling diode on the current continuity.		
	SECTION-C **(2Qx20M=40 Marks)**		
Q.10	Design a single-phase bridge inverter and derive an expression for transient load current for the first two half cycle of output voltage. **OR** Design a single-phase bridge inverter with a DC input voltage of 200V. The inverter is feeding a purely inductive load with a load resistance of 20Ω and an inductance of 50mH. Derive the expression for the transient load current for the first two half-cycles of the output voltage. Assume the inverter operates with a 50Hz output frequency. Calculate the load current at the end of the second half-cycle and draw the current waveform for the first two half-cycles.	**20**	**CO4**
Q.11	Design a four-quadrant hoist load operation. Explain the working of each quadrant and substantiate which quadrants offer regenerative braking.	**20**	**CO4**