Total No. of printed pages = 4

19/6th Sem/DECE 612A

2022

POWER ELECTRONICS

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Draw the static I-V characteristic of a thyristor. What are the three modes of operation of a thyristor? Discuss each of them briefly. 2+3+5=10

   (b) Explain the two-transistor model of a thyristor. Hence, find an expression for the anode current (Ia) in the thyristor. 3+7=10

2. (a) The given circuit shows a controlled AC-DC converter with R-L load.

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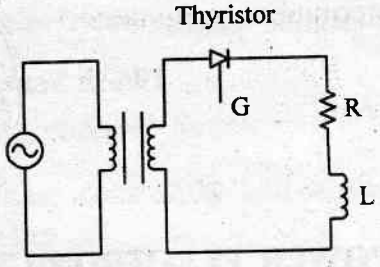


Discuss the operation of the circuit. Why the output current or the output voltage exists when the input voltage becomes negative ? Draw the output voltage, output current, and the thyristor voltage. 4+2+4=10

(b) Discuss the effect of a free-wheeling diode on the controlled AC-DC converter with R-L load. Explain how the output power factor (pf) can be increased. 5+5=10

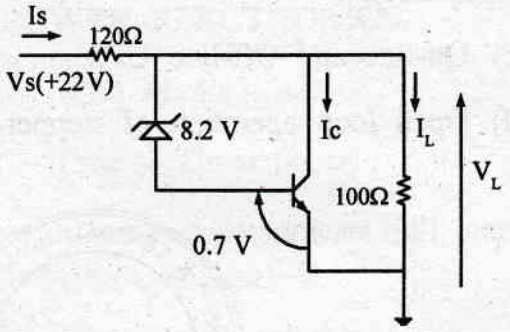
3. (a) Discuss the operation of a single phase full-wave midpoint controlled rectifier with R-L load. Hence draw the output voltage and current. 7+3=10

(b) Discuss the evolution of a 3-phase 6-pulse controlled AC-DC converter. Draw the output voltage for such a converter with resistive load. 4+6=10

4. (a) Discuss the working principle of a shunt regulator. Hence discuss the line regulation for such a regulator. 10+2=12

(b) Determine the regulated voltage (V_L), current (I_L), source current (I_S) and the collector current (I_C) from the figure given below :

2+2+2+2=8



5. (a) Discuss the operation of a full-bridge voltage source inverter and draw the output voltage. Explain the purpose of connecting feedback diodes across the thyristors. 6+2=8

(b) With reference to a three phase voltage source inverter with (180°) conduction and resistive load, draw the phase-to-neutral voltage for any two phases with necessary calculations. 12

6. Write short notes on any *two* from the following : 10+10=20

(a) Step-up chopper circuit

(b) AC phase control by half-wave AC voltage controller

(c) On-line and Off-line UPS

(d) Open loop operation of stepper motor.