Sheet (2)

(1) (a) State and draw the types of AC-AC converters.
(b) What is the control methods used with AC-AC converters?
(c) What are the applications of AC-AC converters?
(d) Draw the circuit and waveforms of a 1-phase AC voltage controller uses ON/OFF control technique; where n=2 and m=1.
(e) What are the disadvantages for using integral cycle control technique?

(2) A heater of 5Ω is fed from an ac supply of 220V; 50Hz via a single-phase AC voltage controller uses ON-OFF control technique. The controller is ON for 2 cycles and OFF for 6 cycles. Determine:
(i) The power consumed,
(ii) The supply power factor.

(3) A 1-phase AC voltage controller (ON-OFF control) supplying a 4Ω heating device. The input voltage is 220V, 50Hz and the power consumed by the heater is 2.42 kW, Determine:
(i) The duty cycle,
(ii) The turn-on and turn-off time,
(iii) The maximum and RMS thyristor currents.

(4) A 1kW electric heater is fed from an AC supply of 220V, 50Hz via 1-phsae ON/OFF controller. The controller is turning OFF for 120ms, and the output power is 0.6kW. Determine:
(i) The number of turning on cycles,
(ii) Duty cycle to obtain 1kW output.

(5) A single-phase AC voltage controller (use integral cycle control) supplying a 4Ω heating device. The input supply voltage is $\sqrt{2}\,208\sin 2\pi 50t$. If the average output power is 8kW. Determine:
(i) Duty cycle,
(ii) Supply power factor,
(iii) The percentage power transferred compared to continuous AC operation,
(iv) The thyristors maximum *dv/dt* and *di/dt* stresses.

(6) A 220V, 50Hz electric boiler raises 1.7 liters of water from 25^0C to 100^0C in 5minutes. The boiler takes 12.5 minutes to raise the same amount of water in the same temperature conditions, when supplied from an on/off voltage controller. The specific heat capacity of water is 4.18 kJ/(kg.^{0}C), assuming that the boiler is good thermally isolated. Determine:
(i) Duty cycle,
(ii) Boiler resistance,
(iii) Output voltage.