Kafrelsheikh University - Faculty of Engineering
Electrical Engineering Department
Course Code: EPM4225
4th Year Electrical Power Students

Final Exam: Power Electronics (2)
Time Allowed: 3 hours
Full mark: 90
Date: 13 - 6 - 2019

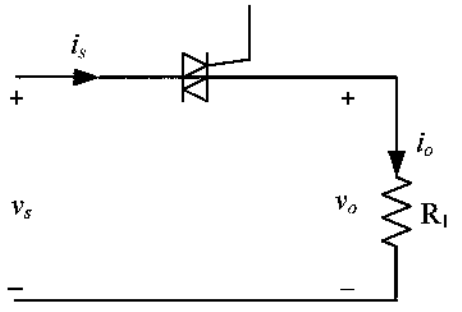
This exam measures the ILOs: a.4, a.5, b.2, b.3, b.5, c.2, c.4

Answer the following THREE questions: In each question, draw the circuit diagram and necessary waveforms and write the necessary equations to clarify your answer

First question: (30 Marks):

(a) Describe the main differences between the power switches (thyristor, MOSFET, IGBT) from the point of view of characteristics of operation, ratings, response and application. (10 Marks)

(b) A single-phase full wave ac voltage controller in the figure has a resistive load of R_1 = 3 Ω and the input voltage is Vs = 240 V, 50 Hz. If the desired output power is P_o =10 kW.
(1) Draw the output voltage v_o wave form and determine:(2) The firing angles of TRIAC (3), The rms output voltage, (4) The input power factor PF, and (5) The rms current of TRIAC (20 Marks)



Second question: (30 Marks):

(a) Describe the power circuit and the control system of the static VAR compensator SVC with type (FC-TCR) to regulate the voltage of the common coupling point. (10 Marks)

(b) A single-phase bridge inverter has an RLC load with R= 10 Ω, L = 31.5 mH, and C = 112 μF. The inverter frequency,f_o= 60 Hz and dc input voltage, V_s= 220V, (1) Express the instantaneous load current in Fourier series. Calculate (2) the rms load current at the fundamental frequency I_1; (3) the THD of the load current; (4) the power absorbed by the load P_0 and the fundamental power P_{0i}; (5) the average current of dc supply, and (6) the rms and peak current of each transistor. (20 Marks)

Third question: (30 Marks):

(a) Discuss the power circuit and the control system of the shunt static synchronous compensator STATCOM to regulate the voltage of the common coupling point. What is the advantage of STATCOM over the conventional SVC. (10 Marks)

(b) A boost regulator has an input voltage of 5 V. The average output voltage 15 V and the average load current 0.5 A. The switching frequency is 25 kHz. If the installed inductor has inductance 150 μH and the installed capacitor has capacitance 220 μF, determine (1) the duty cycle, (2) the ripple current of inductor, (3) the peak current of inductor, and (4) the ripple voltage of filter capacitor. (20 Marks)