COLLEGE OF ENGINEERING & TECHNOLOGY

Department: Electrical & Computer Control Engineering

Lecturer : Prof. Dr. Hamdy Ashour **Marks: 40**

Course : Power Electronics (II) **Time: 2 hours**

Course Code: EE 423

Date : 09/ 01/ 2016

Final Exam

Answer ALL questions

Q1- Design power electronic circuits that can be used to: **(8Marks)** *(A4)*

(a) Control the light intensity of incandescent lamp of 220V/50Hz fed from 220V/50Hz supply

(b) Charging a battery of 18V from 12V output voltage of the photovoltaic cell (PV)

(c) Generate a 4-ph AC supply of 100V/400Hz from 200V battery

(d) Continuously feeding a computer (PC) with 220V/50Hz in case of main supply failure

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Q2- Use simple sketches to discuss concept and typical application of:- **(8Marks)** *(A8, A24)*

(a) 4-Quadrant DC chopper

(b) Sinusoidal Pulse Width Modulation (SPWM)

(c) Gate drive circuit

(d) AC static switch

Q3 **(6 Marks)** *(A8, A24)*

(a) For the circuit shown in figure1 draw wave forms of v_S , v_1, v_2 and vO giving that , $v_S = 24V$, $Np / Ns = 24 / 200$ and gating signals are $Q_1 = \overline{Q_2}$ of 10kHz

(b) For the circuit shown in figure2 draw waveforms of *gate signals*, v_S , i_S and v_O giving that, $v_s = 300\sin(100\pi t)$V , $R_L = 5\Omega$ and T_1 gating signals are repeated each half cycle with firing delay angle $\alpha = 30$ degree.

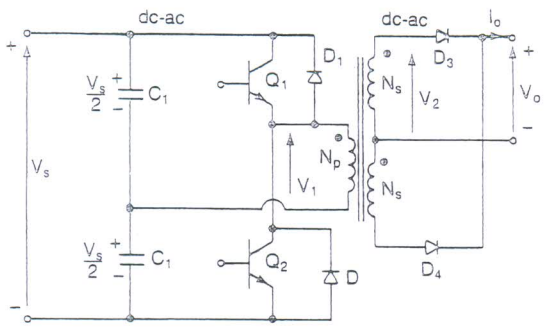

Figure1

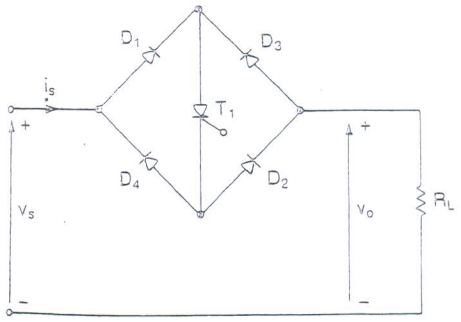

Figure2

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Lecturer: *Prof. Hamdy Ashour*	Hamdy	31/1/2016
Course Coordinator : *Dr Ahemd Kadery*		
Head of Department: *Prof. Hamdy Ashour*	Hamdy	31/1/2016

Q4- For the Cycloconverter circuit, shown figure3, if input voltage v_s = 120V/60Hz

(a) Draw, input voltage (v_s), Thyristors gate signals, and output voltage (v_o) waveforms for delay angle $\alpha_p = 90$ degree and to give output frequency of *30 Hz*.

(b) Calculate the corresponding value of the (Vo) RMS

(6 Marks) *(A24, B2)*

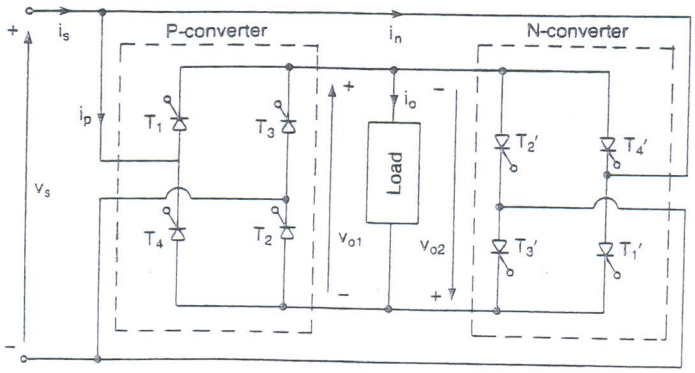

Figure 3

Q5- For the regulator shown in figure4, if the supply voltage V_s = 48V, the required average load voltage V_a = 24V at $R=100\Omega$, ΔV_C = 100mV, ΔI_L = 0.9A, switching frequency is f=10kHz,

(a) Calculate the required duty cycle *k* and values of the filter *L* and *C*.

(b) State two different typical applications of that circuit

(6 Marks) *(A24, B2)*

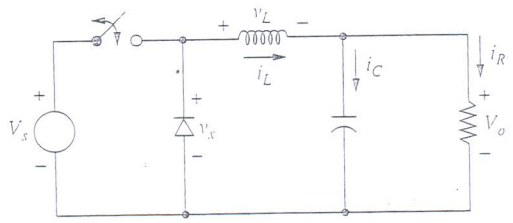

Figure 4

Q6- An H-bridge 1-ph inverter has a load of 5Ω resistive and 20Ω inductive while the battery voltage is 48V.

*(a)*Draw gate signals and waveforms of transistors currents and output voltage to get V_0=48V/25Hz then calculate total harmonic distortion and third harmonic factor.

*(b)*Suggest two different methods to reduce the output voltage to be 24V

(6 Marks) *(A24, B2)*

GOOD LUCK

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Course Coordinator : *Dr Ahemd Kadery*		
Head of Department: *Prof. Hamdy Ashour*	Hamdy	31/12/16

MPC 6/1-1