Menoufiya University | *Course Title: Firing and Control Circuits*
Faculty of Engineering | *Code: ELE 531*
Deploma Examination | *Time Allowed: 3 hours*
Academic Year:2019/2020 | *Date: 19/8/2020*

Answer all Questions

(1)-Draw a block and a circuit diagram for cosine control of phase angle α required to control a single phase thyristor bridge rectifier With the aid of drawing voltage waveforms ,explain the circuit operation . Show that,under continous load current condition, the power circuit together with the control circuit can be represented by a constant gain .

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(2)-Draw the trigger circuit required to control a step-down transistor (IGBT) chopper,using PWM.With the aid of drawing voltage waveforms,explain the circuit operation.Show how to vary the saw-tooth maximum voltage.Also,show how to control the duty cycle and hence the d.c.output voltage.

(3-a) Draw the structure ,equivalent circuit,symbol and characteristics for each of the diac ,SCR,triac and UJT.

(3-b) The frequency of the square wave in Fig.P3 is 50 Hz.It takes exactly one time constant for the capacitor to reach the breakover voltage of the diac.Draw the capacitor voltage,the gate signal voltage and the load voltage over a complete square wave cycle.Determine the maximum value of the control resistance R in KΩ . What are the ideal values of gate current and load current at the instant the diac breaks over ? Also,calculate the rms load voltage and current for R=10 KΩ.

(4-a) A UJT firing circuit,synchronized with the a.c supply ,is used to control a single-phase centre-tap thyristor rectifier. With the aid of drawing voltage waveforms, explain the circuit operation .

(4-b) In the UJT circuit above ,if the delay angle α is controlled manually by varying the charging resistor R. Also,if the zener diode voltage Vz =30 V and the parameters of the UJT are η =0.63 ,Ip = 10 μ A, Vv =3.5 V , Iv =10 mA and the emitter diode voltage V_D = 0.5 V .In addition,let C= 0.4 μF and the width of the triggering pulse tg = 50 μ sec.
Determine:

i) the limiting values of the control resistance ,R.
ii) the maximum value of R when the supply frequency f =50 Hz.
iii) the value of R_{B1} and R_{B2} connected to the UJT bases B_1 and B_2 respectively .

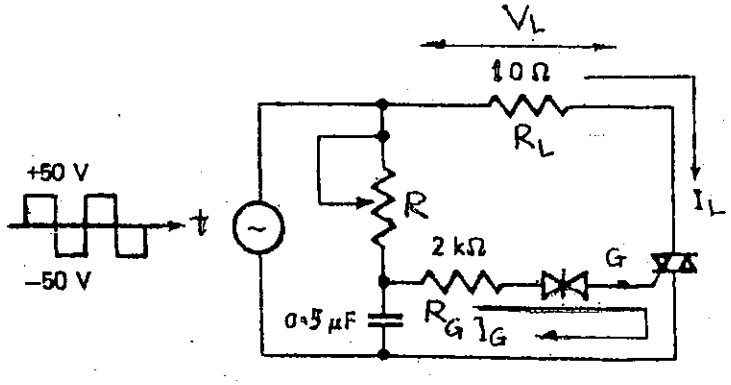

Fig. P3