

GUJARAT TECHNOLOGICAL UNIVERSITY**B.E. Sem-Vth Examination December 2010****Subject code: 150903****Subject Name: Power Electronics-I****Date: 16 /12 /2010****Time: 03.00 pm - 05.30 pm****Instructions:****Total Marks: 70**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Describe construction and working of a SCR. Analyze it's performance using two transistor Analogy. Derive it's expression for it's anode current in terms of current gain ' β ' and leakage Current I_{Co} **07**
- (b) What is snubber circuit? Why is it needed? Draw such circuit for a SCR and give guidelines for selecting it's components. **07**
- Q.2** (a) Explain the working of UJT relaxation oscillator circuit. Derive the expression for frequency of triggering and firing angle delay in terms of η , charging resistance etc. **07**
- (b) Design a UJT relaxation oscillator using UJT 2N2646, for triggering an SCR. The UJT has following characteristics. **07**
- $\eta = 0.7$, $I_p = 50\mu A$, $V_v = 2V$, $I_v = 6mA$, $V_{BB} = 20V$, $R_{BB} = 7K\Omega$, $I_{EO} = 2mA$, also determine the limits for the output frequency of the oscillator.

OR

- (b) List Forced Turnoff methods for SCR and Explain how an auxiliary SCR and a capacitor can be used to turn-off conducting SCR? Draw Necessary waveforms. **07**
- Q.3** (a) Draw the circuit of a single phase fully controlled converter with R-L load. Derive necessary equations and sketch output waveforms. **07**
- (b) A single phase full wave rectifier has a R-L load having $L = 6.5$ mH, $R = 0.5\Omega$ and $E = 10V$. The input voltage is $V_s = 120$ V at (rms) 60Hz supply. Determine (a) The load current I_{Lo} at $\omega t = \alpha = 60^\circ$, (b) The average Thyristor current I_A , (c) The rms Thyristor current I_R (d) the rms output current I_{rms} (e) the average current I_{dc} and (f) the critical delay angle α_c . **07**

OR

- Q.3** (a) With a neat circuit diagram and wave forms describe the Morgan's Chopper circuit states its applications & limitations.. **07**
- (b) Discuss the principles of SCR voltage choppers as **07**
- (i) Buck converter (ii) Cuk converter
- Q.4** (a) Draw the neat circuit diagram of a Jones chopper controlling the speed of a D.C series motor. Explain it's working with the help of various wave forms. Obtain expression for (i) capacitor voltage (ii) Toff period (iii) Relation between battery voltage & capacitor voltage (iv) Value of Capacitor. **07**
- (b) Describe basic chopper circuit and explain various methods of load voltage variations by chopper. **07**

OR

- Q.4** (a) With neat schematic Block diagram describe the Micro-computer control of 4 quadrant DC drives. **07**
- (b) Discuss constant H.P and constant Torque operation of speed control of motors. Specify their field of applications. **07**
- Q.5** (a) Describe the uses of Pulse Transformer and Opto-Coupler in the Gate triggering circuits of SCR'S with necessary sketches. **07**
- (b) Discuss the various techniques of improving the power factor in phase controlled converters. Explain PWM techniques in detail with necessary sketch and waveforms. **07**

OR

- Q.5** (a) Describe IGBT-construction and working characteristic with neat sketches. **07**
- (b) What are the different methods of braking DC motor? Explain regenerative braking scheme with schematic diagram. **07**
