Seat No.: _____ Enrolment No._____

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 ICo **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 eta, charging resistance etc. **07**

(b) Design a UJT relaxation oscillator using UJT 2N2646, for triggering an SCR. The UJT has following characteristics. **07**
η = 0.7, Ip =50μA, Vv=2V, Iv=6mA, VBB=20V, RBB=7KΩ, IEO=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=0.5Ω and E=10V.The input voltage is Vs=120 V at (rms) 60Hz supply .Determine (a) The load current I_{Lo} at wt = α = 60°, (b) The average Thyrister current I_A, (c) The rms Thyrister current I_R (d) the rms output current I_{rms} (e) the average current I_{dc} and (f) the critical delay angle αc. **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 convector (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**

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