

SIXTH SEMESTER B.TECH. DEGREE EXAMINATION, DECEMBER 2010

EE.2K.602/PTEE.2K.502 – Power Electronics

Time: Three hours

PART A

Maximum: 100 marks

(8 x 5 = 40 marks)

- I. a) List few characteristics of power transistors.
- b) Comment on the VI characteristics of IGBT.
- c) Derive an expression for average load voltage for a single phase half-controlled rectifier with resistive load.
- d) Justify the statement "Freewheeling diode improves the power factor of the system".
- e) With the help of circuit diagram, explain the working of a four quadrant chopper.
- f) Explain the speed-torque characteristics of a stator voltage controlled three phase induction motor.
- g) Distinguish between integral cycle control and phase angle control in ac voltage controllers.
- h) List the merits and demerits of on-line and off-line UPS.

(15 x 4 = 60 marks)

- II. 1. a) Explain the switching characteristics of a thyristor.
- b) Explain the principle of operation of an N-channel enhancement MOSFET with the help of a neat circuit diagram.

(OR)

2. a) With a neat sketch, explain the switching characteristics of an IGBT.
- b) Make a comparison on the characteristics of any five power semiconductor devices with their device symbols.

- III. 1. With a neat sketch, explain the operation of a three phase, fully controlled bridge converter. List the firing sequence of the SCRs.

(OR)

2. Discuss the effect of source-inductance on the performance of a single-phase fully-controlled converter, indicating clearly the conduction of various thyristors during one cycle.

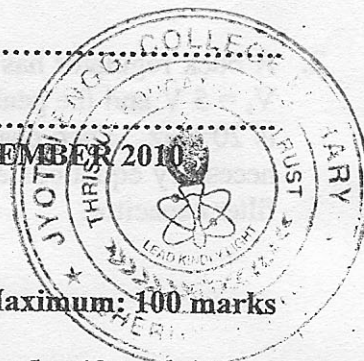
- IV. 1. a) Discuss the modes of cyclo-converter from the waveforms of output voltage and current.
- b) Compare circulating and non-circulating current modes of operation of cyclo-converters.

(OR)

2. With necessary block diagram and equations, explain the operation of v/f control of three phase induction motor.

- V. 1. With the help of block diagram, explain the operation of UPS system.

(OR)



2. A buck regulator has an input voltage, $V_s = 15$ V. The required average output voltage $V_o = 5$ V and the peak-to-peak output ripple voltage is 10 mV. The switching frequency is 20 kHz. Then peak-to-peak ripple current of inductor is limited to 0.5 A. Derive the necessary equations and values for a) the duty cycle, b) the filter inductance, and c) the filter capacitor.