

Elect

College of Engineering, Pune.  
Electrical Engineering Department  
**Class: T.Y.B.Tech-Electrical, Subject: Power Electronics (EE-374),**

**End-Semester Examination-April- 2013**

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Maximum Marks: 50. Time: 3 hours:

Instructions: Question 1 is COMPULSORY. Solve any TWO questions from Q2 to Q4.

Question 1 carries 20 marks; questions from Q2 to Q4 carry 15 marks each.

Assume suitable data, if necessary. Neat circuit diagrams, waveforms carry weight-age.

Q1.: Each bit of Q1 is carrying 4 marks out of which 1 mark should be reserved for correct figure/block/ circuit diagram.

Q2 to Q4 : Each sub question (a) carries 7 marks and sub question (b) carries 8 marks, out of which 1 mark should be reserved for correct figure/block/ circuit diagram. The Numerical also should be solved not mechanically but with proper explanation and proper diagrams/waveforms to attract full marks.

The answers for questions involving differentiation should bring about point by point differentiations and use of diagrams/ waveforms need to be done if required

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- Q1.a) Draw the logic schematics and waveforms for single pulse, multiple pulse and sine pulse width modulations and compare them with respect to fundamental voltages and harmonics.
- b) Draw the circuit diagram for a single phase full wave controlled rectifier with centre tapped transformer input. If the load is a R-L load with  $R = 10 \Omega$ ,  $L = 10 \text{ mH}$  and with the input ac supply of 230 volts, 50 Hz, and firing angle of  $60^\circ$ , what will be the average and rms output voltage? Draw the waveforms for output voltage and current.
- c) Draw the circuit of single phase half bridge inverter with R-L load. Draw the output voltage and current waveforms, write the expression for the instantaneous output voltage for the same. For 200 volts dc input voltage and output frequency of 100 Hz, how much will be the fundamental rms output voltage?
- d) Draw the circuit of a single phase bidirectional AC voltage regulator with R-L load and derive the expression for its instantaneous output current. Draw the necessary waveforms.
- e) Differentiate between Half Bridge and full Bridge Inverters.

Q2.a) Write a detailed note on Dual Converters and their applications.

Q2.b) A step down dc to dc converter has a resistive load of  $10 \Omega$  and the input voltage is 200 V. When the converter switch remains on, its voltage drop is 2 volts and the switching frequency is 500Hz. If the duty cycle is 60%, determine a) the average output voltage, b) the rms output voltage, c) the converter efficiency, d) the effective input resistance of the converter and e) the rms value of the fundamental component of output harmonic voltage.

Q3.a) Explain the operation of the IGBT as a power switch with necessary characteristics and structural diagrams.

Q3.b) A single phase full bridge inverter is operated from a 200 volts dc, supply and is feeding load of  $R = 10 \Omega$ , and  $L = 20 \text{ mH}$ . If the output frequency is 200 Hz, a) express the instantaneous output voltage in Fourier series. Calculate b) rms load current at the fundamental frequency, c) the THD of the load current, d) the fundamental power.

Q4.a) Explain the working of a step up dc to dc converter and derive the output equation for the same.

Explain one application of such a system.

Q4.b) Explain the operation of a three phase bridge inverter with  $180^\circ$  mode of operation with balanced three phase resistive load.