



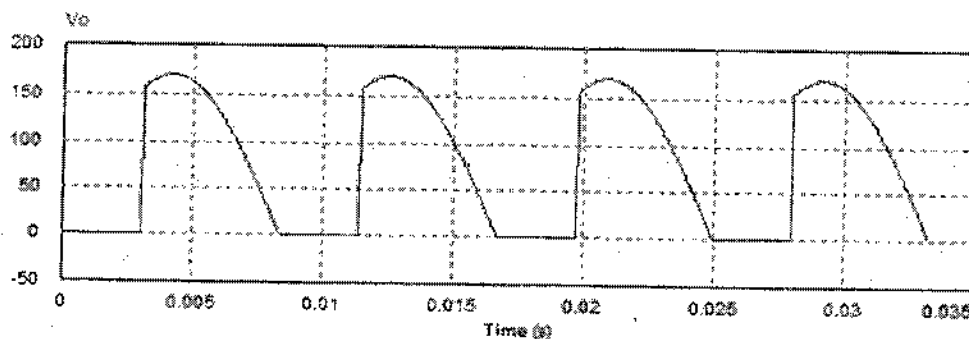
Course	Power Electronics (1)	Date	19-1-2020
Code	EPM3108	Time	3 hours
Students	3 rd Year Electrical Power Engineering	Mark	90

This exam measures the ILOs: a.1, a.5, a.11, a.13, b.1, b.2, b.3, b.4, b.6, b.5, c.2, c.4, c.6, d.1, d.3, d.6, d.7, d.8

Answer the following FOUR questions: Draw the circuit diagrams and necessary waveforms and write the necessary equations to clarify your answer. Assume any missed data

Question One (20 Marks):

A single-phase full-wave controlled rectifier with resistive load of 12Ω . The output voltage waveform is shown below. If this rectifier is used to charge a battery (with $E=45$ Volt) through the resistive load: (a) Draw the waveforms of output voltage and source current versus ωt , (b) Calculate the average and rms values of output voltage.



Question Two (20 Marks):

Design LC filter so that the ripple factor of output voltage is 10 %. The filter is used to reduce the ripple content of the output voltage for a single-phase full-wave uncontrolled rectifier. The load resistance is $R=30 \Omega$, load inductance is $L=10$ mH, and source frequency is 60 Hz.

Question Three (20 Marks):

How is the sinusoidal PWM control working? **Show** analytically using Fourier analysis that the sinusoidal PWM control can eliminate the low order harmonics of source current for a full-wave controlled rectifier with motor load. Consider 4 pulses for each π . **Draw** the spectrum diagram until the 13th harmonic. If the number of pulses per π is increased to 6 pulses, **Draw** the expected spectrum diagram?

Question Four (30 Marks):

Explain the principle of operation of three-phase full-wave uncontrolled and controlled rectification. **Your answer must include:** a) circuit diagram, b) output voltage waveform, c) phase voltages equations, d) line voltages equations and e) average and RMS output voltage equations.