

17/05/19

END SEMESTER EXAMINATIONS, APRIL/MAY, 2019.
B.E. (Full Time) V Semester EE 8503- POWER ELECTRONICS , R(2012)
ANNA UNIVERSITY , Chennai -25

Time : 3 Hours

Max Marks :100

Answer ALL Questions

Part-A

10 x 2 = 20

1. Define : Power factor
2. Draw the circuit diagram of a single phase half wave rectifier supplying R load.
3. Sketch the load voltage and supply current waveforms of a single phase full wave rectifier supplying R load.
4. What are the advantages of using freewheeling diode in phase controlled rectifier circuits?
5. Draw the circuit diagram of a boost chopper.
6. Define : THD
7. A single phase full bridge square wave inverter supplies a RL load. Sketch the load voltage and load current waveforms.
8. Define : Amplitude modulation index and frequency modulation index
9. Draw the symbol for the following power devices. Also write the names of the terminals (i) SCR (ii) TRIAC (iii) MOSFET (iv) IGBT
10. A single phase voltage controller is employed for controlling the power flow from 230 V, 50Hz source into a load circuit consisting of $R = 3\Omega$ and $\omega L = 4\Omega$. Calculate (i) the control range of firing angle (ii) maximum power supplied to the load.

Part- B (5x16=80)

11. A three phase full wave rectifier using diodes feeds power to a load of R.
 - (i) Describe the working of the converter (4)
 - (ii) Sketch the load voltage and line current (4)
 - iii) Derive expressions for (i) Average load voltage (ii) Fundamental power factor (iii) True power factor. (2 + 3+3)
 12. (a) (i) A single phase full converter is connected to RLE load . Explain the working of the converter as a line commutated rectifier and inverter. Sketch the relevant waveforms . (8)
(ii) A single phase full converter is connected to RLE load. The source voltage is 230V, 50 Hz. The average load current is 12 A. For $R = 0.5\Omega$ and $L = 3mH$, compute firing angle delay for $E = 100V$ and $E = -100V$ (8)
- (OR)
- 12 (b) Explain the working of a three phase half controlled converter with R load . Sketch the output voltage for $\alpha = 30^\circ$ and 90° . Derive the expression for average output voltage. (16)
 - 13(a) Draw the circuit diagram of boost DC to DC converter and explain the modes of operation under continuous conduction mode. Sketch the steady state inductor



current and capacitor voltage waveforms for one switching cycle. Find the voltage gain, minimum inductance and capacitance values to maintain continuous conduction mode of the converter.

(OR)

- 13(b)(i) Explain the operation of buck-boost converter and derive the expression for average output voltage? (8)
- (ii) A buck converter has an input voltage of 15 V and the required output voltage is 6 V at $R = 200 \Omega$ and the peak to peak output ripple voltage is 20 mV. The peak to peak ripple current of inductor is 0.8 A and the switching frequency is 50kHz. Determine (i) duty cycle ratio (ii) filter inductance and capacitance (8)

- 14(a)(i) With a neat circuit diagram, explain the principle of operation of a single phase half bridge inverter supplying RL load. (6)
- (ii) A single phase full bridge inverter feeds an RL load with $R = 10 \Omega$ and $L = 10 \text{ mH}$. The inverter employs single pulse modulation technique. The width of the pulse is 120° . The source voltage is 100V and output frequency is 50Hz.
- (i) Find out the total harmonic distortion in the output voltage. (5)
- (ii) Give the expression for instantaneous fundamental load current. (3)
- (iii) Find the fundamental power delivered to the load. (2)

(OR)

- 14(b) Explain the working of a three phase bridge inverter (180° mode of conduction) feeding a balanced star connected resistive load. Draw waveforms of load phase and line voltages.

- 15(a) (i) What is a cycloconverter? Give any two industrial applications of Cyclo converters. (4)
- (ii) Describe the principle of working of 1ϕ to 1ϕ step-down and step-up Cyclo converters. Sketch the output voltage and indicate the conduction of various devices. (6 + 6)

(OR)

- 15(b)(i) Explain the working principle of single phase ac voltage controller? What is the effect of load inductance on the performance of ac voltage controller? (8)
- (ii) A single phase AC voltage controller supplies a resistive load of $R = 10 \Omega$. The source voltage is 230 V, 50 Hz. The load RMS voltage is 50% of maximum possible load RMS voltage, determine (i) firing angle (ii) RMS load current (iii) supply power factor. (8)

