(3 Hours) [Total Marks: 80]

N. B.: (1) Question No. 1 is compulsory.
(2) Attempt any **THREE** questions from the remaining five questions.
(3) Assume suitable data if necessary.
(4) Figures to the right indicate full marks.

Q1. Attempt **any four** questions. **20**

a) What problems will be faced if thyristors are used in an inverter circuit?
b) State true or false with justification: Buck-boost converters are difficult to model and control.
c) Explain the process of torque generation in a DC motor.
d) An induction motor basically works on the principle of Lenz's Law. Explain the meaning of this statement.
e) What are SMPS? Explain any SMPS circuit with the help of neat waveforms.

Q2. a) Compare with the help derivation, the output DC voltage of a single-phase fully controlled bridge rectifier with and without source inductance. Can it be concluded that source inductance is an undesired factor in the performance of a controlled rectifier? **10**

b) In a 3-Φ full converter working in rectifier mode, input supply is 440V (L-L) 50 Hz AC. If firing angle $\alpha = \Pi/4$ and load current is 20A constant with load voltage = 370V, determine source inductance Ls and overlap angle μ. **10**

Q3. a) Derive and explain the average state space model of Buck Converter. Use this state space model to derive equation for output voltage of the converter at equilibrium condition (dv/dt=0). **10**

b) Explain various feedback control methods for DC-DC converters. Which method is best suitable for efficient control? Which method does not require mathematical model of the converter? **10**

Q4. a) Given a single phase AC supply, design a power electronic circuit to charge a battery. How will you decide the current requirement of the circuit? **10**

b) List the desirable features of an UPS. Explain on line and off line UPS. **10**

Q5. a) A 220V, 1500 rpm, 10 A separately excited DC motor has Ra=2 Ω and is fed from single phase fully controlled bridge rectifier with source voltage of 230V, 50Hz. Assuming continuous load current, compute: **10**

(i) Motor speed at firing angle of 45 degrees and torque of 4 N-m.

(ii) Developed torque at firing angle of 30 degrees and speed of 1200 rpm.

b) Explain the variable frequency control method for speed control of induction motor for two different working modes. **10**

Q6. Write short notes on (**any two)** **20**

i) Importance of output filter in an inverter.

ii) Advantages of SVM over conventional sine wave PWM.

iii) Modeling of DC-DC converter.

iv) Induction heating.