(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) Compare fully controlled bridge converter and semi-converter.
b) List the factors affecting the speed of an induction motor.
c) Explain the principle of operation of DC motors.
d) State true or false with justification: The transfer function model of a buck converter is of second-order.
e) Give advantages of induction heating when compared to other conventional methods of heating.

Q2. a) Derive an expression for Overlap angle (μ) and output voltage for a three phase fully controlled bridge rectifier with source inductance. **10**

b) Explain the SVM technique for 3-phase voltage source inverters. Draw sector diagram. **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) A separately excited DC motor is supplied from 230V, 50 Hz, AC source through a single phase half wave controlled converter. Its field is fed through single phase semi-converter with zero degree firing angle delay.

Motor resistance= 0.70 Ω; motor constant =0.5Vsec/rad.
For a rated load torque of 15 N-m at 1000 rpm and for continuous ripple free current, determine

a. Firing angle delay of armature converter.
b. RMS value of thyristor current and free-wheeling current. **10**

b) Explain the working of single-phase full converter drive for separately excited DC motor. **10**

Q5. a) Compare the V/f and stator voltage speed control methods for an induction motor. Which method is more popular in practice? Justify your answer. **10**

b) Draw and explain the torque-speed characteristics of an induction motor. Explain which region of the characteristics is most suitable for the stable operation of the motor. **10**

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

i) Static Scherbius drive.
ii) Battery charging system.
iii) Role of DC-DC converter in SMPS circuits.
iv) Regenerative braking of induction motor.