Ref. No.: Ex/PE/IEE/T/226/2019

B.E. Power Engineering Second Year Second Semester 2019
Power Electronics

Time: 3 hours **Full Marks: 100**

*Answer any **five** questions from the following:*

1. (a) What do you mean by chopper circuit? Explain with proper diagram. 5

   (b) Explain dc-dc switch mode converters with proper block diagram. 5

   (c) Derive the expressions for I_{max} and I_{min} (as shown in Fig.1.) of a step down chopper with RLE load. 10

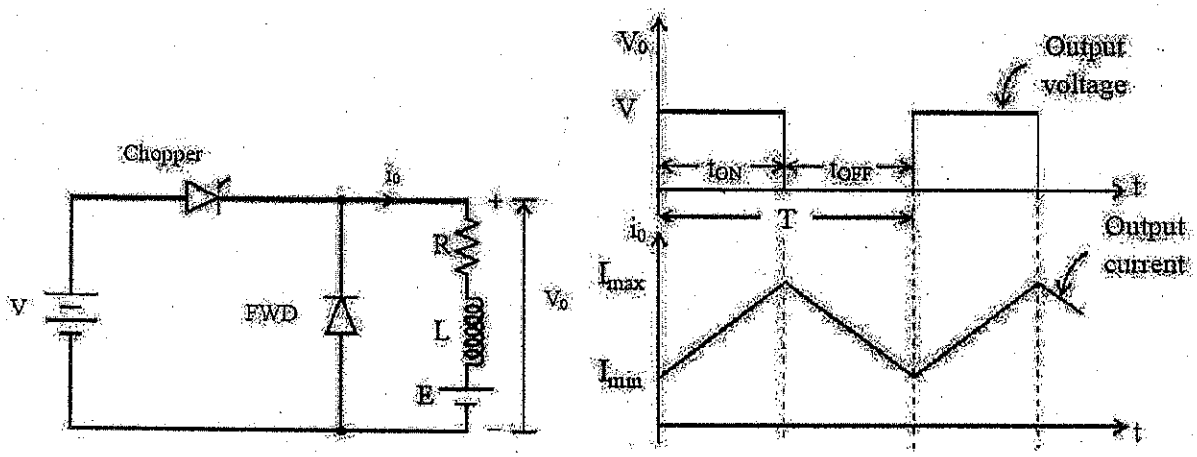

Fig.1.

2. (a) Explain the operation of uncontrolled single phase full wave bridge rectifier with proper diagram. 5

   (b) Two Bulbs Of 100w And 40w Respectively Connected In Series Across A 230v Supply Which Bulb Will Glow Bright And Why? 2

   (c) What is the effect of freewheeling diode on a rectifier circuit? 3

   (d) Explain with proper waveform the operating principle of freewheeling diode for single-phase controlled half wave rectifier circuit (assume the nature of the load is RL and supply voltage $V_m \, Sin \, \omega \, t$) and also calculate the output current for conduction mode as well as freewheeling mode. 4+3+3

3. (a) Explain the switching characteristics of a power transistor with proper diagram. 7

(b) Describe with sketch the construction of IGBT. 7

(c) Define: (i) reverse recovery time, (ii) reverse recovery current, (iii) softness factor of a power diode. 2+2+2

4. (a) Explain the operation of AC circuit breaker with circuit diagram. 6

(b) i) What is the difference between power diode and signal diode? 2

ii) What losses occur in a thyristor during working conditions? 2

iii) Mention some of the applications of power electronics in our daily life. 2

iv) What is meant by PWM control in dc chopper? 2

(c) Explain speed control of the motor by using TRIAC with the help of circuit diagram. 6

5. (a) What is meant by GTO? How does a GTO differ from a conventional thyristor? 2+4

(b) What are the differences between force commutated and line commutated cycloconverter? 4

(c) Analyze the operation of a 3 phase AC voltage controller. 5

(d) Explain the basic construction and working principle of power MOSFET with proper diagram. 5

6. (a) 1×10=10

(i) An ideal power diode must have

a) low forward current carrying capacity b) large reverse breakdown voltage

c) high ohmic junction resistance d) high reverse recovery time

(ii) The power loss in which of the following cases would be the maximum?

a) When both V & I are minimum b) When both V & I are maximum

c) When only V is maximum d) When only I is maximum

(iii) For a p-n junction diode, the peak inverse current & the reverse recovery time are dependent on

a) inverse voltage, b) forward Voltage, c) di/dt, d) all of the above mentioned

(iv) Choose the correct statement

a) MOSFET is a uncontrolled device b) MOSFET is a voltage controlled device

c) MOSFET is a current controlled device d) MOSFET is a temperature controlled device

(v) Which of the following devices does not belong to the transistor family?

a) IGBT, b) MOSFET, c) GTO, d) BJT

(vi) What is firing angle?

(vii) What is inverter?

(viii) What is duty cycle?

(ix) Why the capacitor works on ac only?

(x) Name two current controlled (current driven) devices?

(b) Why thyristor is considered as charge controlled device? 2

(c) What is the difference between isolator and circuit breaker? 2

(c) Input to the step up chopper is 200 V. The output required is 600 V. If the conducting time of thyristor is 200 μsec. Compute (i) Chopping frequency, (ii) If the pulse width is halved for constant frequency of operation, find the new output voltage. 6

7. Write short notes on any ***four*** the following: 4×5

(a) Load commutated cycloconverter

(b) Protection of thyristor

(c) Forced commutation of SCR

(d) UJT relaxation oscillator

(e) Step-up chopper