Exam.Code:1018
Sub. Code: 35261

2055

M.E. Electrical Engineering (Power System)
Second Semester
EE-8204(b): Power Electronics Converters for Smart Grid

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt any five questions.

x-x-x

1. With help of equivalent circuit and relevant waveforms, explain the effect of
   (a) Capacitive Snubber (5)
   (b) Adding a Snubber Resistance. (5)

2. (a) State the importance of Turn-off snubber as applicable to Power Converters. (3)
   (b)The Turn-off snubber for a thyristor circuit does not include a diode as it does for the BJT and MOSFET, explain why. (3)
   (c) Draw the equivalent circuit for a Turn-off snubber and derive the equations related to its design. (4)

3. (a) For a fully controlled 3 phase full converter feeding a RLE load explain the rectifier and inverter mode of operation. Sketch three phase input voltages, table of sequence of triggering switches for firing angle 60 degrees and for 120 degrees and the output voltage. (6)
   (b) Discuss and compare unipolar and bipolar PWM switching schemes in terms of harmonic content and switching loss. (4)

4. (a) Illustrate the working principle of a DC–DC bidirectional converter used in electric vehicle charging systems. With help of waveforms discuss both modes of operation. (5)
   (b) Explain the concept of grid-connected inverters and their role in modern smart grids. Discuss synchronization and anti-islanding in brief. (5)

5. (a) Explain how multilevel inverters reduce harmonics. Compare a capacitor based 3-level and 5-level topologies in terms of THD and switch stress. (6)
   (b) Explain the significance of the modulation index in sinusoidal PWM (SPWM) inverter operation. Derive the relationship between the modulation index and the fundamental output voltage. (4)

6. (a) Explain the working of a series resonant DC-DC converter with help of key waveforms and operating modes. (6)
   (b)Explain the need and benefits of using isolated flyback converters in smart grid applications. (4)

7. (a) Compare closed-loop PWM control and feedforward control for DC-DC converters in terms of response to load and line disturbances. (5)
   (b) Explain current mode control for output voltage with a neat block diagram and describe its effect on power converter stability. (5)

8. Write short notes on the following:
   a) Z-source converter (5)
   b) Cascaded AC-AC converter with high-frequency link (5)

x-x-x