Exam.Code:1018
Sub. Code: 7465

2061

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. Derive the expression for duty cycle 'D' of a buck-boost converter with suitable waveforms under continuous and discontinuous conduction mode. (10)

2. a) In a step-up converter, consider all components to be ideal. Let Vd be 8-16V, Vo = 24V (regulated), fs = 20 kHz and C = 470 μF. Calculate Lmin that will keep the converter operating in a continuous -conduction mode if Po ≥ 5W.
   b) Explain the operating principle of parallel loaded resonant dc-dc converter under discontinuous conduction mode with suitable diagrams. (3,7)

3. Explain the Uni-polar, bi-polar and isolated drive configurations with suitable diagram. (10)

4. Discuss the sine wave PWM and space vector modulation (SVM) strategies, and compare them in terms of total harmonic distortion (THD), switching losses, and output voltage waveform quality. (10)

5. In a single-phase full-bridge PWM inverter, the input DC voltage varies in a range of 295-325 V Because of the low distortion required in the output vo, ma≤ 1.0.
   (a) What is the highest V_{01}, that can be obtained and stamped on its voltage rating?
   (b) Its nameplate volt-ampere rating is specified as 2000VA, that is, $V_{01,max}I_{0,max}$= 2000 VA, where i_o is assumed to be sinusoidal. Calculate the combined switch utilization ratio when the inverter is supplying its rated volt-amperes. (10)

6. Describe the topology of cascaded multi-level inverters (MLIs) commonly employed in grid-tied photovoltaic (PV) systems. Explore techniques for reducing harmonic distortion in an MLI for enhancing power quality. (10)

P.T.O.

7. Consider the step-down converter circuit shown in Fig. 1 without the turn-on snubber. The dc input voltage Vd is 500V, the load current Io=500A, and the switching frequency is 1 kHz. The free-wheeling diode has a reverse-recovery time trr = 10μs. The GTO has a current fall time t_{fi}=1μs, a maximum reapplied voltage rate dv/dt = 50 V/μs, and a maximum controllable anode current I_{AM}=1000A.

   (a) Find the appropriate values for resistance Rs and capacitance Cs for the turn-off snubber circuit.

   (b) Estimate the power dissipated in the snubber resistance.

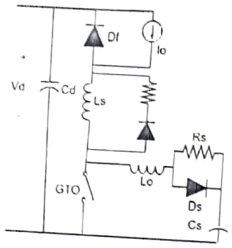

Fig. 1

8. (a)The turn-off snubber for a thyristor does not include a diode as it does for the BJT and MOSFET. Explain Why? (10)

   (b)Explain the effect of adding a snubber resistance with suitable waveforms. (2x5)

x-x-x