Department of Electrical, Electronics and Computer Engineering
Kathmandu Engineering College
Electronic Circuit-II (3EA, 3EB & 3EC)

Assignment No.2 Instructor: Ajay Kumar Kadel
Issued Date: Due Date:

Group A (Descriptive Questions)

1. Explain the working of SCR with its characteristic curve.
2. Explain the two transistor analogy for SCR.
3. Write short notes on step graded junction and linearly graded junction. (Refer to your course manual page 100)
4. Describe the characteristics of a tunnel diode in terms of energy band diagram.
5. Describe the operation of a triac triggering circuit.
6. Derive the expression for maximum ripple in a step down chopper with RL load for a continuous current.
7. Write short notes on classification of choppers.
8. Derive an expression for the peak to peak ripple voltage of the capacitor in a buck regulator.
9. Derive an expression for the peak to peak ripple voltage of the capacitor in a buck regulator.
10. Describe the operation of Buck-Boost regulator with the help of a circuit diagram and corresponding waveforms.
11. Draw a block diagram of a switched mode power supply (SMPS).
12. Describe the operation of Buck-Boost regulator. Find ripple voltage, load current and load voltage. Draw all the relevant waveforms.

Group B (Numerical Questions)

1. A buck regulator provides a regulated output voltage of +12 V. If the unregulated input voltage at a certain time is +24 V, determine the on time (t_{on}) of the appearing at the base of the transistor if the transistor is being switched at 10 kHz.

2. A basic boost regulator circuit uses a pulse width modulation as its control circuitry. The on time and off time for both equals to 50 μs. For an unregulated input voltage of +12 V, determine the output voltage. Also, determine the change in on time of the drive waveform when unregulated input changes to +18 V.

3. The buck regulator has an input voltage of V_s=12V. The required output voltage is V_a=5V and the peak to peak output ripple voltage is 20mV. The switching frequency is 25 kHz. If the peak to peak ripple current of inductor is limited to 0.8A, determine a) duty cycle b) filter inductance L c) filter capacitance C

4. An SCR is connected for half wave power control and supplies power to a 200 ohm load resistor from a 230 V source supply. If the trigger voltage is adjusted so that conduction starts at 60° after the start of each cycle, calculate the readings of the following meters. (a) a true rms reading ammeter in series with a load (b) a true rms reading voltmeter connected across SCR (c) a wattmeter inserted in the circuit so as to read the total power delivered by ac supply. Neglect SCR voltage drop.

5. A step up chopper has input voltage of 220 V and output voltage of 660 V. If the non conducting time of thyristor is 100 μsec. Compute the pulse width of the output voltage. In case pulse width is halved for a constant frequency operation, find the new output voltage.

6. A thyristor having r.m.s. on state rating of 40 A is used in an a.c. 50 Hz. resistive circuit. Find average on state current rating if conduction period in each is a) 170° b) 100° c) 40°

7. A resistance of 100 Ω is fed by a 230 V single phase ac supply through a thyristor if the thyristor is fired at 60° during each cycle, a) find the power supplied to the load. b) If the thyristor is fired at 45° during each cycle, find the power supplied to the load. c) Find the average load current in each case.

8. The buck-boost regulator has an input voltage of Vs=12 V. The duty cycle k =0.25 and the switching frequency is 25 kHz. The inductance L =150 μH and filter capacitance C =220 μF. The average load current Ia =1.25 A. Determine a) the average output voltage, V_a (b) the peak to peak output voltage ripple ΔV_c (c) the peak to peak ripple current of inductor, ΔI (d) the peak current of the transistor Ip and (e) the critical values of L and C.

9. A boost regulator has an input voltage of V_s =5V. The average output voltage V_a = 15 V and the average load current I_a=0.5A. The switching frequency is 25 kHz. If L=150μH and C=220μF, determine (a) the duty cycle k, (b) the ripple current of inductor ΔI (c) the peak current of inductor I_2 (d) the ripple voltage of filter capacitor ΔV_c and (e) critical values of L and C.

10. A half wave rectifier circuit employing an SCR is adjusted to have a gate current of 1mA. The forward break down voltage of SCR is 100 V for Ig =1mA. If the sinusoidal voltage of 200V peak is applied. Find
    a. Firing angle
    b. Conduction angle
    c. Average Current

11. An ac. voltage V=240sin314t is applied to an SCR. If the SCR has a forward breakdown voltage of 180V. Find the time during which SCR remains off.

12. The SCR circuit is adjusted so that the conduction angle commences 90° after the start of each positive half cycle of applied voltage. The SCR voltage drop is negligible. The applied voltage of 306 V rms sinusoidal and the load is 50 Ω resistor. Calculate
    a. Average Current
    b. The d.c. load current
    c. The power dissipated by the load
    d. rms load current

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