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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Electrical and Electronics Engineering

Semester End Examination ; Dec. - 2014

Power Electronics

Time: 3 hrs

Max. Marks: 100

Note: i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.
ii) Assume suitable missing data if any.

PART - A

1. a. Describe various types of power converter systems with their input and output waveforms. 10
- b. Discuss the control characteristics of SCR, MOSFET and GTO with relevant circuit and waveforms. 6
- c. Mention the peripheral effects of power converter system. What are their remedies? 4
2. a. With necessary waveforms, explain the switching characteristics of a power MOSFET. 8
- b. What is the need of base drive control? Explain proportional control with relevant circuit. 6
- c. A transistor shown in Fig. 2(c) has the value of β in the range of 8 to 40. Calculate:
 - i) The value of R_B which results in saturation with an overdrive factor of 5. 6
 - ii) The forced β_f and
 - iii) The power loss in transistor.
3. a. Explain in brief any four methods of turn ON of an SCR. 8
- b. What is the need to protect thyristors? Explain the $\frac{dv}{dt}$ and $\frac{di}{dt}$ effect and their protection against these. 8
- c. In the circuit shown in Fig. 3(c), the thyristor is gated with a pulse width of 40 μ s. The latching current of thyristor is 36 mA. For the given load will the thyristor gets turned on? Check. How one can overcome the difficulty if it is not turned ON? Find the remedial parameter of the load. 4
4. a. What do you mean by commutation? Explain in brief with relevant circuit and waveforms line and load commutation. 8
- b. With the help of circuit and waveforms, explain complementary commutation. 6
- c. The resonant pulse commutation circuit has capacitance $C = 30 \mu$ F and inductance $L = 4 \mu$ H. The initial capacitor voltage is $V_0 = 200$ V. Determine the circuit turn-off time if the load current is 50 A. 6

Contd...2

PART - B

- 5. a. With necessary circuit and waveforms, explain the concept of phase control of an ACVC. 8
- b. A single phase ACVC has an input voltage of 230 V, 50 Hz and a load of 15 Ω. For 6 cycles ON and 4 cycles OFF, Determine; 4
 - i) RMS output voltage ii) Input power factor iii) Average and RMS thyristor currents.
- c. For a 1 φ FW ACVC supplied from 230 V, 50 Hz with a load resistance of 10 Ω. For $\alpha_1 = \alpha_2 = \alpha = 30^\circ$, determine; i) RMS o/p voltage ii) RMS current iii) Average thyristor current and iv) Power factor. Derive the formulae used for first and third conditions. 8
- 6 a. With the help of circuit diagram and waveforms, explain the principle of operation of step-up chopper. 8
- b. With relevant circuit and operating characteristics, explain one quadrant and two quadrant choppers. 8
- c. A type A chopper has an input voltage of 230 V with a load resistance of 10 Ω. Take a voltage drop of 2 V when it is on. For a duty cycle of 0.4, calculate; 4
 - i) Average and rms values of output voltage
 - ii) Chopper efficiency.
- 7 a. With the help of circuit and waveforms, explain the operation of single phase half wave rectifier with free wheeling diode. Mention the advantages of freewheeling diode. 10
- b. With the help of circuit and waveforms, explain the working of a single phase full bridge converter. 10
- 8 a. Explain the principle of working of a single phase full bridge inverter with relevant waveforms. What are their advantages over half bridge inverter? 6
- b. With the help of circuit and waveforms. Explain the operation of 3-phase bridge inverter operating with 120° mode of operation. 8
- c. Explain the various methods of external control of DC input voltage to inverter. 6


