

Code: A-26

Subject: POWER ELECTRONICS

December 2005

Time: 3 Hours

Max. Marks: 100

NOTE: There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q. 1. must be written in the space provided for it in the answer book supplied and nowhere else.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or best alternative in the following: (2x10)**

a. The device which has the highest reverse blocking voltage is

- (A) MOSFET. (B) BJT.  
(C) SCR. (D) IGBT.

b. The relation between  $\alpha_1$  and  $\alpha_2$ , in a three phase dual converter is

- (A)  $\alpha_1 + \alpha_2 = 180^\circ$  (B)  $\alpha_1 - \alpha_2 = 180^\circ$   
(C)  $\alpha_1 + \alpha_2 = 360^\circ$  (D)  $\alpha_1 + \alpha_2 = 0^\circ$

c. A class D chopper operates in

- (A) a single quadrant. (B) two quadrants.  
(C) three quadrants. (D) four quadrants.

d. A single phase Dual Converter uses

- (A) natural commutation.  
(B) forced commutation.  
(C) both natural and forced commutation.  
(D) none of this.

e. The output RMS voltage of a single phase AC voltage controller in on-off control mode with n cycles ON and m cycles OFF is

- (A)  $v_o = v_s \left( \frac{n}{m+n} \right)$  (B)  $v_o = v_s \left( \frac{n}{m+n} \right)^2$



constant load current with (i) firing angles of  $0^\circ$ ,  $30^\circ$ ,  $45^\circ$  and  $60^\circ$ . Assume a thyristor drop of 1.5 V and an ac line voltage of 220 V.

(8)

**Q.4** a. Explain the operation of a resonant pulse chopper with waveforms. (8)

b. A buck chopper is shown in Fig.1. The input voltage is  $V_s=115\text{V}$ , the average load voltage is  $V_a=62\text{V}$ , and the average load current is  $I_a=24\text{A}$ . The chopping frequency is  $f=25\text{ KHz}$ . The peak-to-peak ripples are 2.5% for load voltage, 6% for load current, and 12% for filter  $L_e$  current. Determine the values of  $L_e$ ,  $L$  and  $C_e$ . (8)

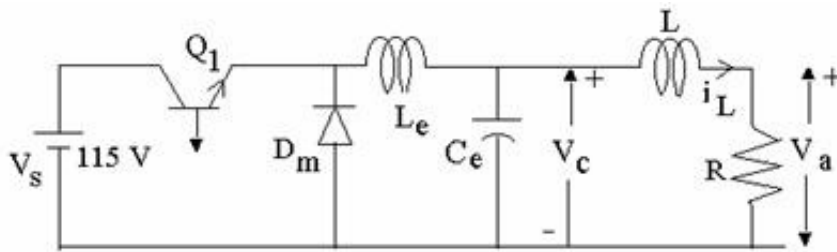


Fig.1

**Q.5** a. Explain line side commutation with a circuit diagram and derive the expression for circuit turn-off time. (10)

b. Explain the process of 'natural commutation'. (6)

**Q.6** a. Explain the operation of a single phase A.C. voltage controller with an inductive load. (8)

b. Explain single phase tap changing transformer operation with waveforms. (8)

**Q.7** a. Explain the operation of a single-phase cyclo-converter with RL load. (8)

b. Explain the technique for reduction of output harmonics in a cyclo-converter. (8)

**Q.8** a. Explain the multiple pulse-width modulation technique for a single-phase inverter, with waveforms. (10)

b. Compare multiple pulse-width modulation with sinusoidal pulse-width modulation. (6)

**Q.9** a. With a neat block diagram describe the speed control of a d.c. drive. (10)

b. Draw the speed torque characteristics of A.C. induction motor for variable speed drive

application.

(6)