Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: 714501N **Date: 08/01/2013**

Subject Name: Power Electronics-I

Time: 02.30 pm – 05.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** The three phase full-wave bidirectional AC voltage controller supplies a Y-connected load of 10 ohm and the line to line voltage is 208 V(rms), 60 Hz. The delay angle is $\pi/3$. Determine (a) The rms output voltage Vo, (b) The input P.F, and (c) The Expression for the instantaneous output voltage of phase a. **07**

(b) Derive the Expression for output phase voltage of three phase full-wave bidirectional delta connected controller and draw all phase and line current waveform for resistive load. **07**

Q.2 **(a)** Derive equation for output voltage Vo, of dc-dc CUK Converter and explain it with all necessary circuits and waveforms. **07**

(b) In a cuk converter operating at 50 KHz, L_1=L_2=1mH and C_1= 5μF. The output capacitor is sufficiently large to yield essentially constant output voltage. Here V_d=10 V(input voltage) and output voltage Vo is regulated to be constant at 5 V. it is supplying 5W to the load. Assume ideal components. Calculate the percentage errors in assuming a constant voltage across C1 or in assuming constant current i_{L1} and i_{L2}. **07**

OR

(b) Derive output voltage equation for dc-dc Boost converter when it operates with **07**

(1) Discontinuous conduction mode with constant input voltage Vd.

(2) Discontinuous conduction mode with constant output voltage Vo.

Also discuss boundary condition between continuous and discontinuous condition.

Q.3 **(a)** Explain Latching Effect in IGBT **07**

(b) Explain need and types of electrical isolation circuit in gate and base drive circuit **07**

OR

Q.3 **(a)** Draw and Explain Vertical Cross Section Of the Power MOSFET **07**

(b) A buck regulator has an input voltage of 15 V. The average output voltage is 7.5V and the average load current is 0.5 A. The switching frequency is 25 kHz. If L = 150 μH and C = 220 μF, determine (i) the ripple current of inductor, (ii) the peak current of inductor, (iii) the ripple voltage of filter capacitor **07**

Q.4 **(a)** Explain Dual converter with circulating current operation and give it's advantage and disadvantage. **07**

(b) Design a dual converter to achieve a four- quadrant operation of the separately exited d.c.motor. **07**

(1)motor specifications:

Ea=200 v, Ia= 30A, N=1500 rpm.

(2)converter specifications:

Supplied from 3-phase, 400 V, 50 Hz supply

Assume drop in the circuit 10%

OR

Q.4	**(a)**	Give the advantage of PWM techniques and explain sinusoidal PWM technique.	**07**
	(b)	A single phase half-bridge inverter has a resistive load of R=3 ohm and the dc input voltage Edc=24 V. determine (a)IGBT ratings (b)THD (c)The distortion factor (d) the harmonic factor and distortion factor for lower order harmonics.	**07**
Q.5	**(a)**	Explain the push-pull converter with neat circuit diagram and draw all the waveform related to the circuit.	**07**
	(b)	Explain 3-phase bridge inverter in 120 degree conduction mode and draw it's output phase and line voltage wave form with resistive load.	**07**

OR

Q.5	**(a)**	Explain 3-phase bridge inverter in 180 degree conduction mode and draw it's output phase and line voltage wave form with resistive load.	**07**
	(b)	Explain design step for Heatsink	**07**

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