

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 V_o , (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 V_o , of dc-dc CUK Converter and explain it with all necessary circuits and waveforms. **07**

(b) In a cuk converter operating at 50 KHz, $L_1=L_2=1\text{mH}$ and $C_1=5\mu\text{F}$. The output capacitor is sufficiently large to yield essentially constant output voltage. Here $V_d=10\text{ V}$ (input voltage) and output voltage V_o 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 C_1 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 V_d .
(2) Discontinuous conduction mode with constant output voltage V_o .
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 **07**
and the average load current is 0.5 A. The switching frequency is 25 kHz. If $L = 150\mu\text{H}$ and $C = 220\mu\text{F}$, determine (i) the ripple current of inductor, (ii) the peak current of inductor, (iii) the ripple voltage of filter capacitor

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

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

$E_a=200\text{ V}$, $I_a=30\text{ A}$, $N=1500\text{ rpm}$.
(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 $R=3\text{ ohm}$ and the dc input voltage $E_{dc}=24\text{ V}$. 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**
