APPENDIX A

DESIGN and PRACTICAL READINGS for REGULATED POWER SUPPLY
A.1 DESIGN FOR REGULATED POWER SUPPLY

As explained in chapter 7 regulated power supply is controlled transistor series regulator and equations used to determine values of resistors are standard transistor equations.

As $T_1$ is series pass element its $V_{CEO}$ should be high and as per datasheet of 2N3773 $V_{CEO}$ is 140V hence this power transistor is selected. For $T_2$ current gain and $V_{CEO}$ should be high and as per datasheet of 2N3501 $h_{FE}$ is 300(maximum) and $V_{CEO}$ is 150V hence this transistor is selected. BD139 is used for negative feedback from output.[Ref. Fig. 7.3]

The voltage provided by potential divider $R_1'$ and $R_2'$ is equal to sum of base-emitter voltage of transistor $T_3$ and zener diode.

$$V_{BE3} + V_Z = V_2' = \frac{R_2'}{R_2 + R_1} V_{out}$$

Output voltage required is 40V or 80V, zener is taken as 6.2V for emitter voltage of $T_3$. Assume value for one of the resistors and find other. Negative feedback gain can be adjusted by inserting potentiometer in circuit. Current through zener is limited by resistance $R_1$.

$$I_Z = \frac{V_1 - V_Z}{R_1}$$

where $V_1$ is unregulated DC obtained from bridge rectifier.

$I_Z$ is $I_{E3}$ which is maximum 1A from datasheet ($I_C = I_E + I_B$) thus $I_Z$ taken as less then 500mA. Hence from equation $R_1$ is found.

A.2 PRACTICAL RESULTS FOR REGULATED POWER SUPPLY

Practical readings obtained for voltage regulator are given in Table A.1 and A.2. Transformer used is 230/40V and 210/40V for testing. Load resistor is varied such that output current is from 0 to maximum i.e 5A. Load regulation is calculated by given equation:

$$\% \ Load \ Regulation = \frac{(V_{NL} - V_{FL})}{V_{NL}} \times 100$$

where $V_{NL}$ is output voltage at no load

$V_{FL}$ is output voltage at full load
### Table A.1 Load regulation for 230V input

<table>
<thead>
<tr>
<th>Unregulated output (V)</th>
<th>Regulated output voltage(V)</th>
<th>Load current(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54.7</td>
<td>42.3</td>
<td>0</td>
</tr>
<tr>
<td>50.7</td>
<td>39.9</td>
<td>1.5</td>
</tr>
<tr>
<td>49.7</td>
<td>39.8</td>
<td>2</td>
</tr>
<tr>
<td>49</td>
<td>39.7</td>
<td>2.5</td>
</tr>
<tr>
<td>47.8</td>
<td>39.6</td>
<td>3</td>
</tr>
<tr>
<td>46.5</td>
<td>39.5</td>
<td>4</td>
</tr>
<tr>
<td>45.5</td>
<td>39.4</td>
<td>4.5</td>
</tr>
<tr>
<td>44.5</td>
<td>39.3</td>
<td>5</td>
</tr>
</tbody>
</table>

% Load Regulation = \( \frac{(42.3 - 39.3)}{42.3} \times 100 \)  
= 7.09%

### Table A.2 Load regulation for 210V input

<table>
<thead>
<tr>
<th>Unregulated output (V)</th>
<th>Regulated output voltage(V)</th>
<th>Output current(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55.5</td>
<td>40.8</td>
<td>0</td>
</tr>
<tr>
<td>51.5</td>
<td>40.4</td>
<td>1.5</td>
</tr>
<tr>
<td>50.4</td>
<td>40.3</td>
<td>2</td>
</tr>
<tr>
<td>49.3</td>
<td>40.2</td>
<td>2.5</td>
</tr>
<tr>
<td>47.9</td>
<td>40.2</td>
<td>3</td>
</tr>
<tr>
<td>46.3</td>
<td>39.9</td>
<td>4</td>
</tr>
<tr>
<td>45.3</td>
<td>39.6</td>
<td>4.5</td>
</tr>
<tr>
<td>44.9</td>
<td>38.1</td>
<td>5</td>
</tr>
</tbody>
</table>

% Load Regulation = \( \frac{(40.8 - 38.1)}{40.8} \times 100 \)  
= 6.61%
APPENDIX B

PHOTO GALLERY
Fig. B.1 Hardware for control and power circuit

Fig. B.2 Buffer, optoisolator, driver and power switch
Fig. B.3 Panel for control and power circuit

Fig. B.4 Gating signals
Fig. B.5 Emulator and EPB28335

Fig. B.6 Hardware for regulated power supply
Fig. B.7 Panel for regulated power supply

Fig. B.8 Primary voltage selector
Fig. B.9 Setup for current measurement

Fig. B.10 Load
Appendix B

Photo Gallery

Fig. B.11 System setup

Fig. B.12 Emulator connected
Fig. B.13 Project built

NOTES:

Gel will enable XINTFx15 during Debug only.
Enable XINTF in code prior to use.
FPU Registers can be found via GEL->Watch FPU Registers.
APPENDIX C

WORKSHOPS ATTENDED
and PAPERS
PRESENTED/PUBLISHED
Appendix C

Workshops attended

- ISTE approved Short Term Training Programme on “Recent Trends in Electrical Drives” 27th December 2010 to 1st January 2011 conducted by Department of Electrical Engineering, Institute of Technology, Nirma University, Ahmedabad.
- Workshop on “Embedded systems and VLSI Design”, April 11-15, 2011, conducted by Electrical Engineering Department, Faculty of Technology & Engineering The Maharaja Sayajirao University of Baroda
- Workshop on “Smart Controllers 2012 Embedded Controllers for Solid State Drives & Power Converters”, August 21-25, 2012, conducted by Electrical Engineering Department, Faculty of Technology & Engineering The Maharaja Sayajirao University of Baroda

Papers Presented/Published


