**DESIGNING OF POWER SUPPLY:-**

A)  The following information must be available to the designer of the transformer.

1. power output.
2. operating voltage.
3. Frequency range.
4. Efficiency and regulation.

Size of core is one of the first consideration in regard of weight and volume of a transformer. This depends on type of core and winding configuration used. Generally following formula is used to find Area or Size of the Core.

Ai = √ Wp / 0.87

Where Ai = Area of cross section in square cm.

Wp = Primary Wattage.

For our project we require +5V output, so transformer secondary winding rating is 9V, 500mA.

So secondary power wattage is,

P2 = 9 \* 500mA

= 4.5Watt

So,

Ai = √ 4.5 / 0.87

= 2.43

Generally 10% of area should be added to the core.

So,

Ai = 2.673

**a) Turns per volt:-** Turns per volt of transformer are given by relation.

Turns per volt = 100000 / 4.44 f \* Bm \* Ai

Where,

F = Frequency in Hz.

Bm = Density in Wb / Square meter.

Ai = Net area of the cross section.

Following table gives the value of turns per volt for 50 Hz frequency.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Flux density 0.76 Wb /sq m | 1.14 | 1.01 | 0.91 | 0.83 |
| Turns per Volt  45 / Ai | 40 / Ai | 45 / Ai | 50 / Ai | 55 / Ai |

Generally lower the flux density better the quality of transformer. For our project we have taken the turns per volt is 0.91 Wb / sq.m from above table.

Turns per volt = 50 / Ai

= 50 / 2.673

= 18.7055

Thus the turns for the primary winding is,

230 \* 18.7055 = 4302.265

And for secondary winding,

9 \* 18.7055 =168.3495

**b) wire size :-** As stated above the size is depends upon the current to be carried out by winding which depends upon current density. For our transformer one tie can safely use current density of 3.1 Amp / sq.mm.

for less copper loss 1.6Amp/sq.mm or 2.4sq.mm may be used generally even size gauge of wire are used.

R.M.S secondary voltage at secondary to transformer is 9V. so maximum voltage Vm across secondary is

= 9 \* 1.141

= 12.727v

D.C output voltage Vm across secondary is,

Vdc = 2 \* Vrms/pi

= 2 \* 12.727/3.14

= 8.08 V

P.I.V rating of each diode is

PIV = 2Vdc

= 2 \* 8.08

= 16.16 V

Maximum forward current, which flow from each diode is 500 mA. So from above parameter, we select diode 1N4007 from the diode selection manual.

B) **Design of filter capacitor:-**

Formula for calculating filter capacitor is

C = ¼ √ 3 r \* F \* R1

Where,

r = ripple present at output of rectifier, which is maximum 0.1 for full wave rectifier.

F = frequency of AC main.

R1 = input impedance of voltage regulator IC

C = 1/( 4 \*( √ 3 \* 0.1 \* 50 \* 28))

= 1030 µf

= 1000 µf

Voltage rating of filter capacitor should be greater than the i/p Vdc i.e. rectifier output which is 8.08 V so we choose 1000µf / 25V filter capacitor

C) **Specification of voltage regulator IC:-**

|  |  |
| --- | --- |
| **Parameter** | **Rating** |
| Available output DC voltage. | +5V |
| Line regulation. | 0.03 |
| Load regulation. | 0.5 |
| Vin maximum. | 16.16 V |
| Ripple rejection. | 60-80db |