**1)**

**a)** Current passes through transformers when Sw1 and Sw2 or Sw3 and Sw4 is closed. In one period Ts, Sw1, Sw2 and Sw3, Sw4 is closed for D\*Ts amount of time separately. So in each period current passes through transformer 2\*D\*Ts amount of time and D can not be more than 0.5 because it will cause short circuit. Otherwise, this push pull converter works similarly to buck converter. Vs = 12V, Vo = 48V, D = 0.4 from this we can calculate turns ratio.

There is 5 secondary winding for 1 primary winding.

**b)** When D is on voltage across Lx is . D is on for DTs time. Also, from Pout = Vout\*Iout = Vout\*ILx (average of Iout = ILx because average current across capacitor is 0) we can find average current across inductor which is 96/48 = 2 A. Which means our required current ripple is 2\*0.1 = 0.2A. From inductor formula we can find ripple current on inductor.

**c)** Average output voltage is 48 V so our required ripple is 48\*0.01 = 0.48 V. Current passing through capacitor is ILx – Iout. And we can calculate capacitance by from charge formula.

ΔQc is total charge accumulated when ILx – Iout > 0. Because average of ILx is Iout total time when ILx – Iout > 0 and this is push pull converter is quarter period. ILx at peak is Iout + (Iripple /2). Which means (First ½ is because of triangular shape of ILx – Iout).

From this we can calculate required capacitance by