

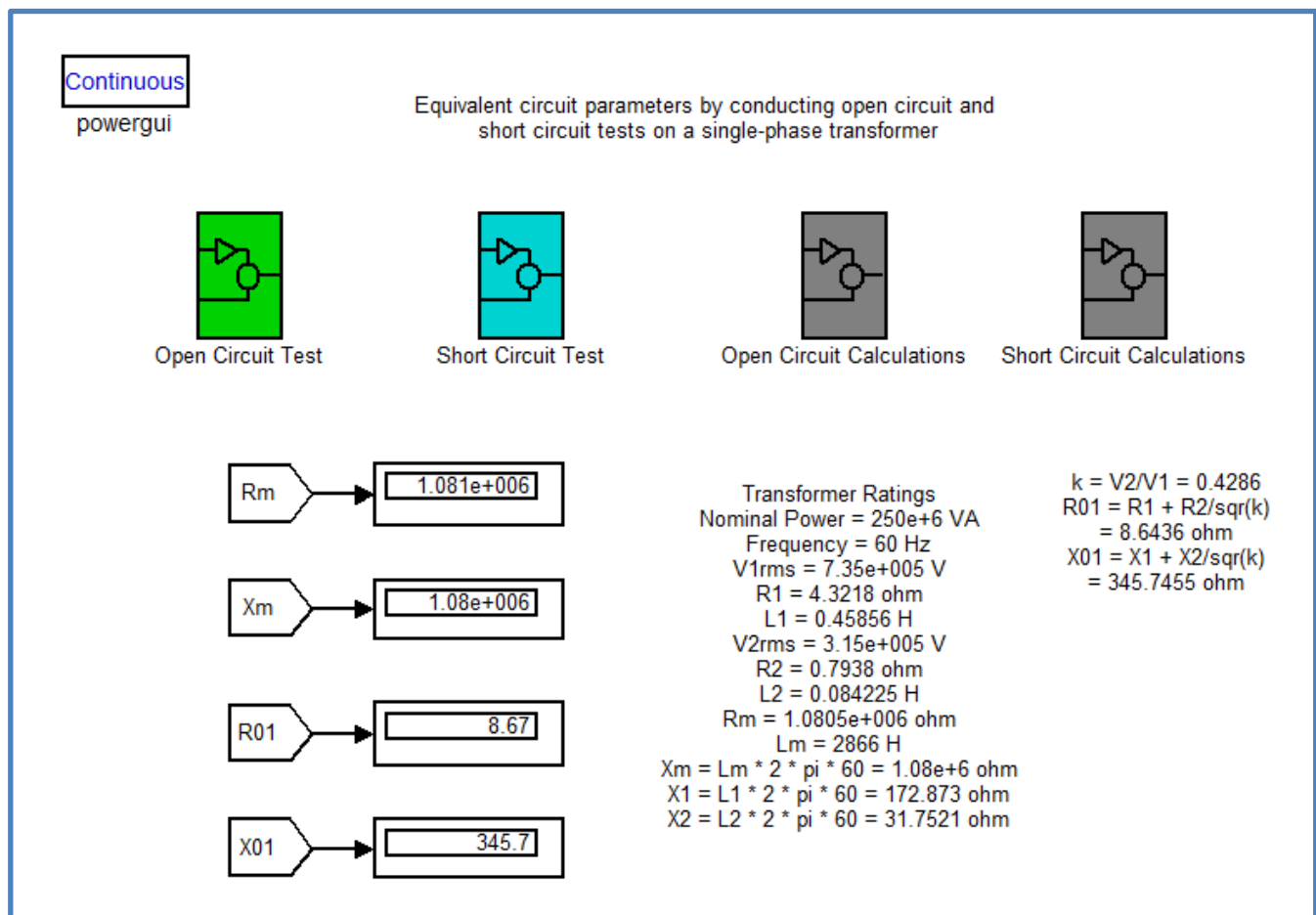
### Exercise – 2.2

Use **MATLAB (Simulink)** to

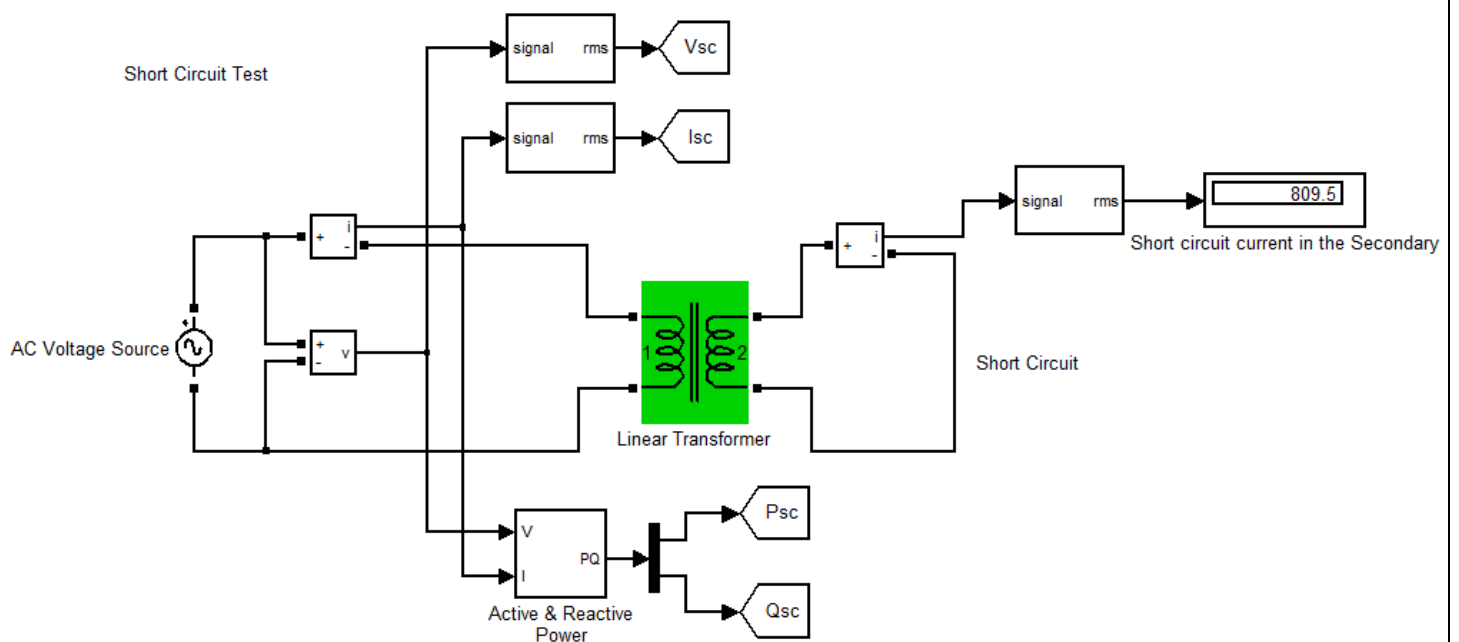
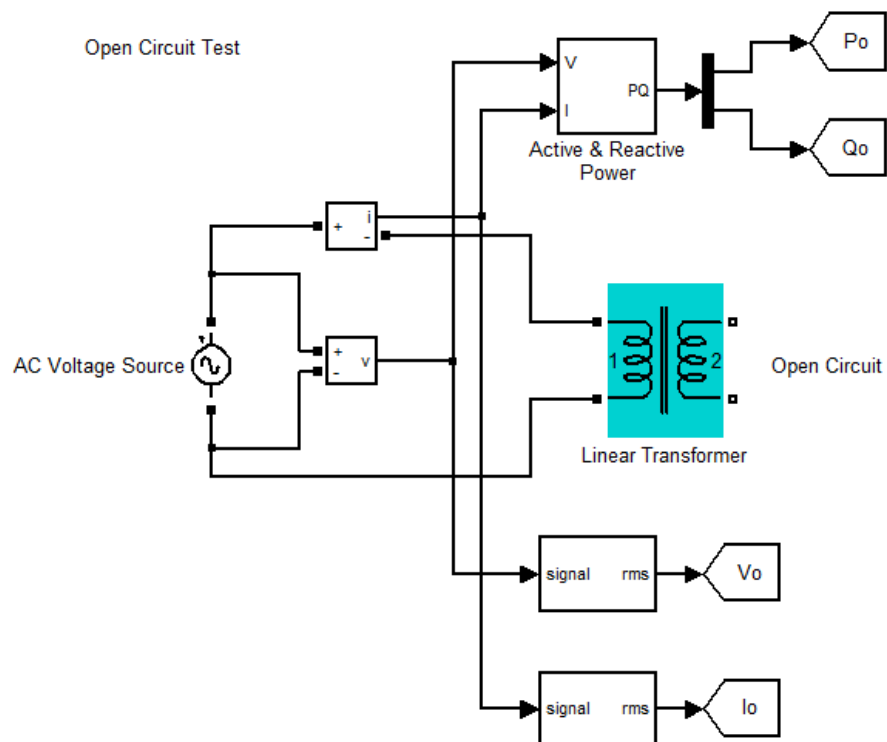
- i. obtain the equivalent circuit parameters (referred to primary) by conducting the **open circuit** and **short circuit** tests on a given **single phase transformer**
- ii. calculate the **efficiency** and **voltage regulation** at 50% loading with 0.8 power factor lagging
- iii. **plot/display** the following for the above loading conditions:
  - a. primary and secondary current
  - b. real and reactive power at the primary and secondary terminals
  - c. primary and secondary power factor
  - d. efficiency

## Simulink Circuit:

### i. Equivalent circuit parameters



Open circuit test	Short circuit test
Apply rated voltage at primary and open circuit the secondary	Apply voltage at primary such that rated short circuit current flows through the secondary Rated current at sec = 793.65 ampere ( VA / V <sub>sec</sub> )



## Formulae:

### Open Circuit Test

$$\phi = \cos^{-1} \frac{P_o}{V_o I_o}$$

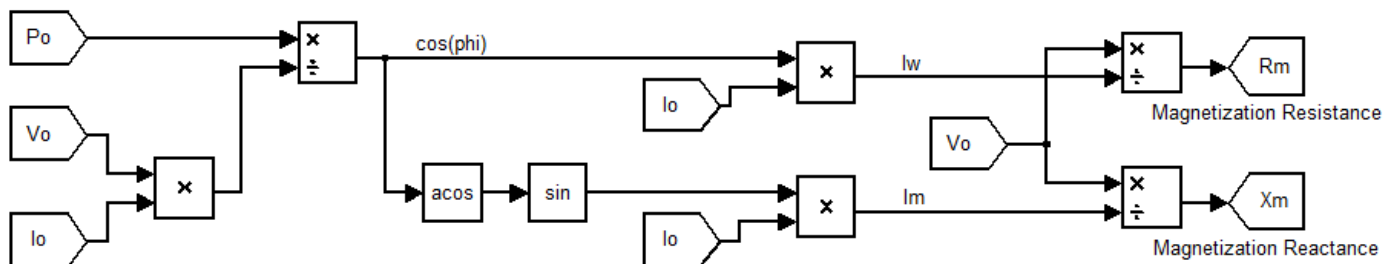
$$I_w = I_o \cos \phi$$

$$I_m = I_o \sin \phi$$

$$R_m = \frac{V_o}{I_w}$$

$$X_m = \frac{V_o}{I_m}$$

Open Circuit Calculations



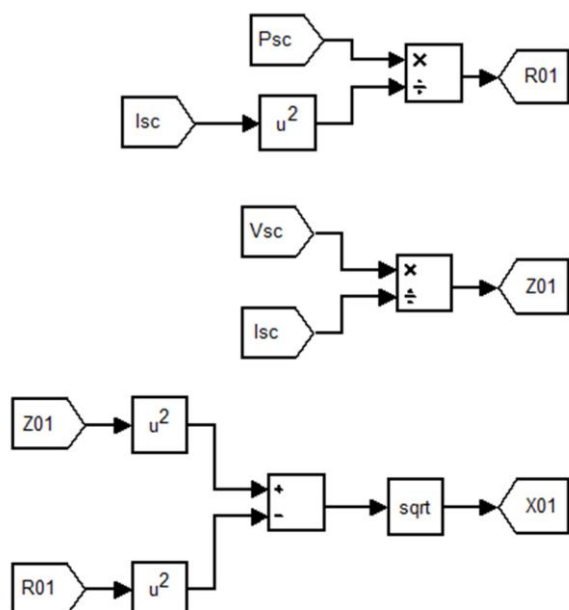
### Short Circuit Test

$$R_{o1} = \frac{P_{sc}}{I_{sc}^2}$$

$$Z_{o1} = \frac{V_{sc}}{I_{sc}}$$

$$X_{o1} = \sqrt{Z_{o1}^2 - R_{o1}^2}$$

Short Circuit Calculations

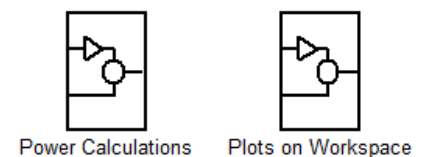
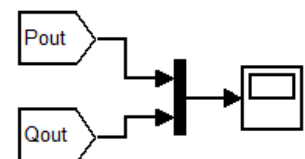
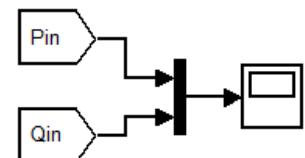
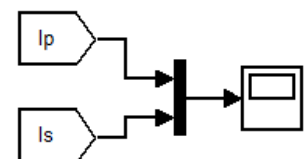
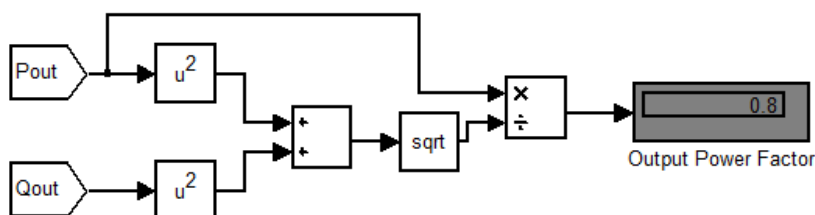
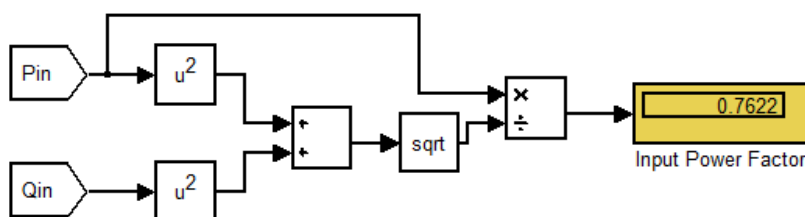
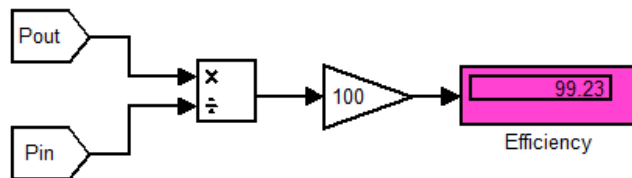
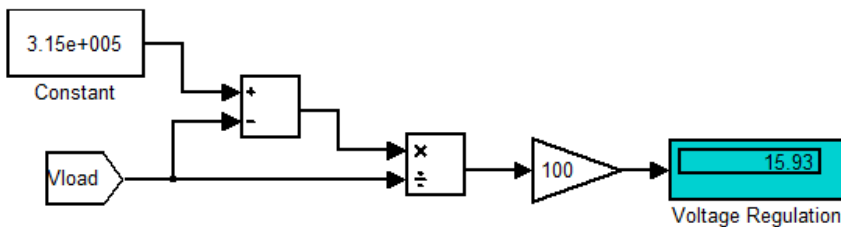
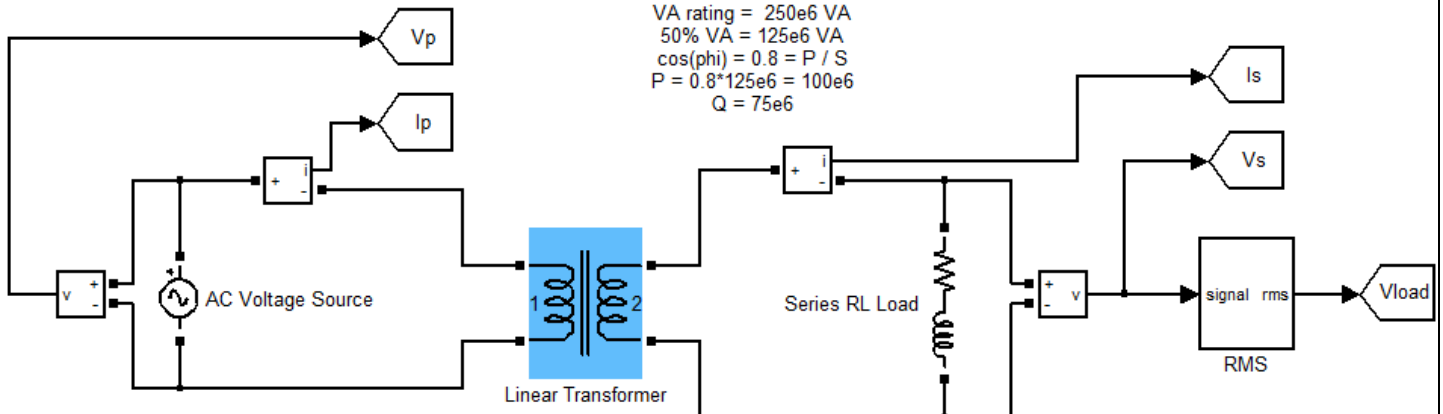


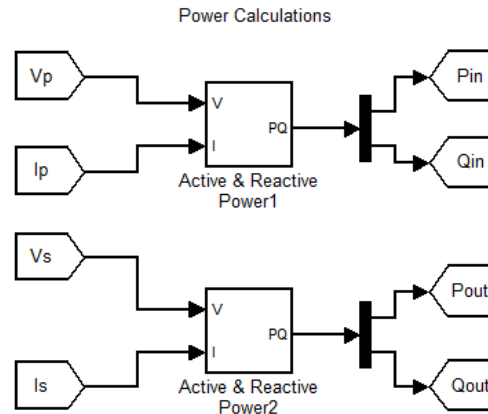
ii. efficiency and voltage regulation

Continuous  
powergui

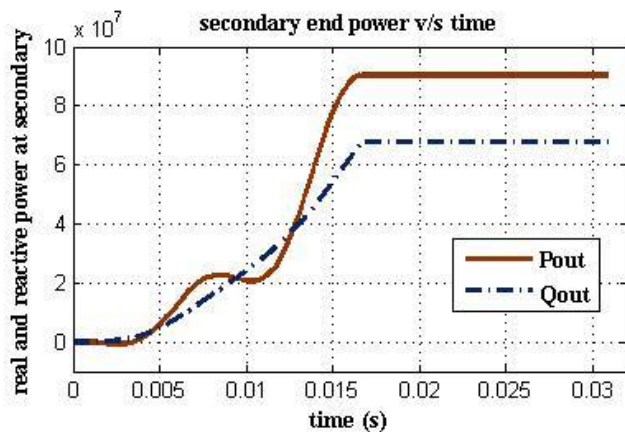
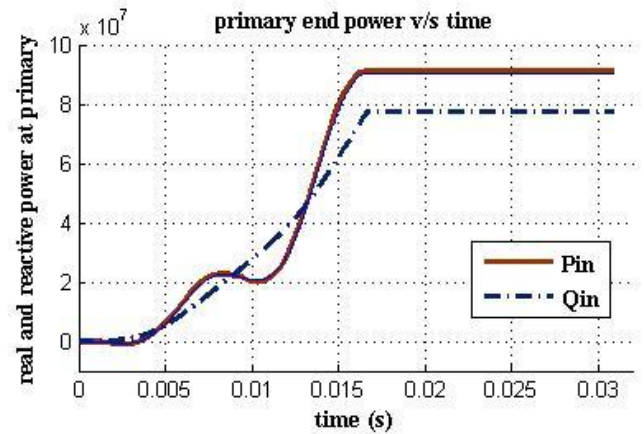
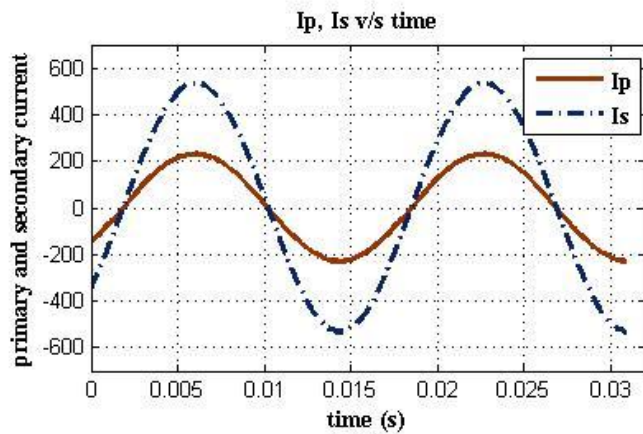
50% load at 0.8 power factor (lagging)

VA rating = 250e6 VA  
50% VA = 125e6 VA  
 $\cos(\phi) = 0.8 = P / S$   
 $P = 0.8 \times 125e6 = 100e6$   
 $Q = 75e6$





iii. plots for the above loading conditions



**Results:**

Hence the equivalent circuit parameters of a single phase transformer obtained from the open circuit and short circuit tests are verified and the waveforms for specified load conditions are plotted using MATLAB (Simulink).