

LOAD TEST ON THREE-PHASE INDUCTION MOTOR

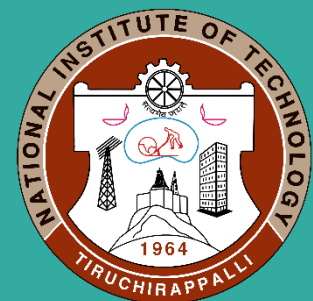
JUNE 12

GROUP 1

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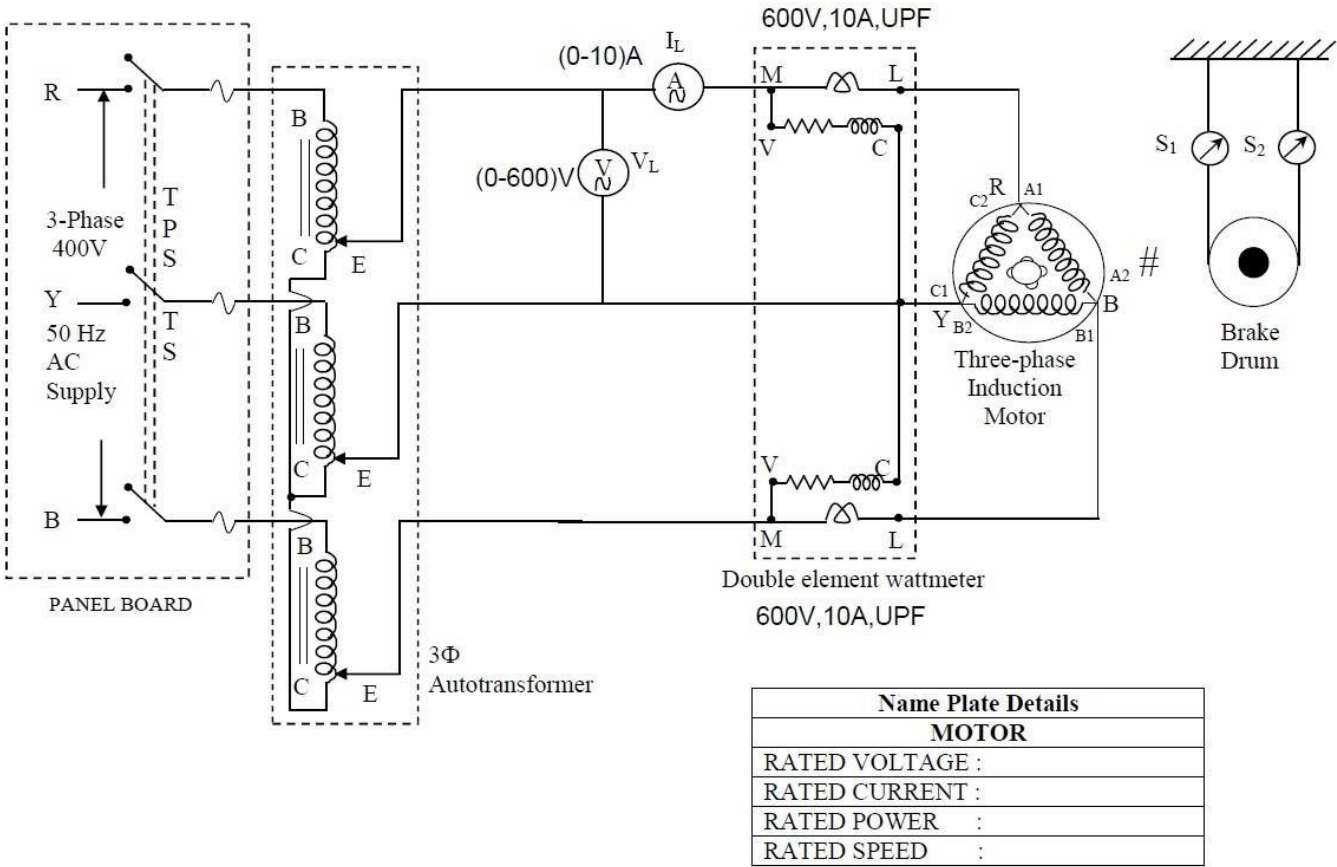
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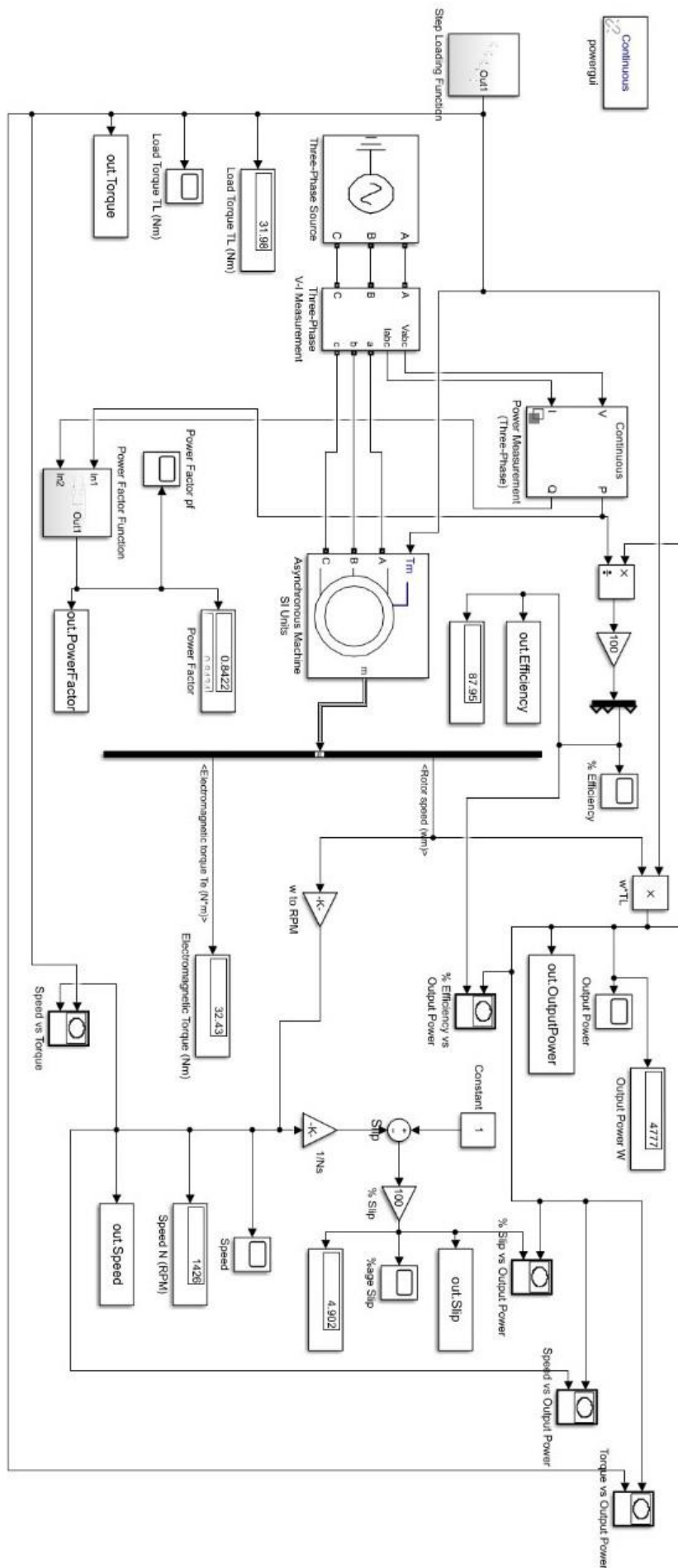


Circuit Diagram-

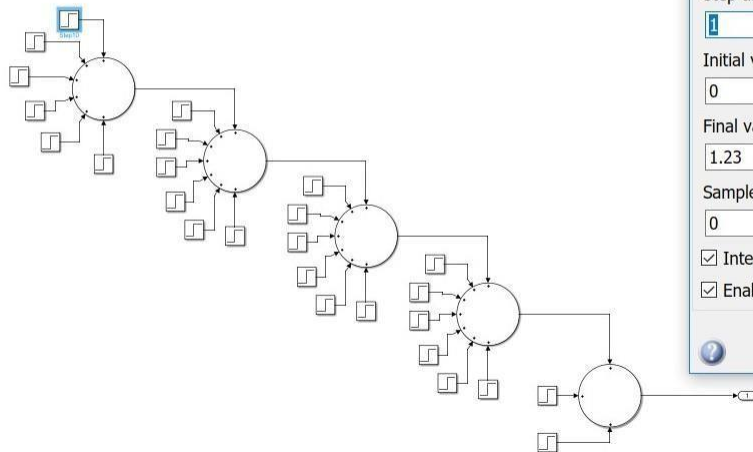
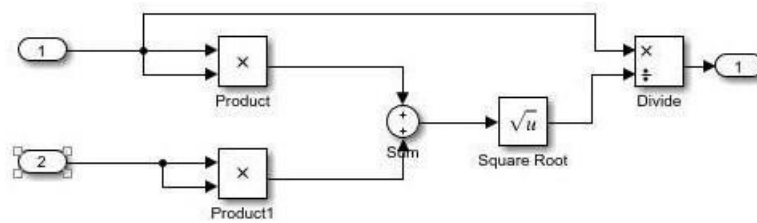
CIRCUIT DIAGRAM – LOAD TEST ON THREE-PHASE INDUCTION MOTOR



Simulation Diagram -



Sub-Systems used-



Block Parameters: Step10

Step
Output a step.

Parameters

Step time:
1

Initial value:
0

Final value:
1.23

Sample time:
0

☒ Interpret vector parameters as 1-D
☒ Enable zero-crossing detection

OK Cancel Help Apply

Operating Conditions -

Block Parameters: Three-Phase Source

Three-Phase Source (mask) (link)
Three-phase voltage source in series with RL branch.

Parameters Load Flow

Configuration: Yg

Source

☐ Specify internal voltages for each phase

Phase-to-phase voltage (Vrms): 415

Phase angle of phase A (degrees): 0

Frequency (Hz): 50

Impedance

☐ Internal ☐ Specify short-circuit level parameters

Source resistance (Ohms): 0

Source inductance (H): 0

Base voltage (Vrms ph-ph): 25e3

OK Cancel Help Apply

Block Parameters: Asynchronous Machine SI Units

Asynchronous Machine (mask) (link)
Implements a three-phase asynchronous machine (wound rotor, squirrel cage or double squirrel cage) modeled in a selectable dq reference frame (rotor, stator, or synchronous). Stator and rotor windings are connected in wye to an internal neutral point.

Configuration Parameters Load Flow

Nominal power, voltage (line-line), and frequency [Pn(VA),Vn(Vrms),fn(Hz)]: [3700 415 50]

Stator resistance and inductance [Rs(ohm) Lls(H)]: [1.405 0.005839]

Rotor resistance and inductance [Rr'(ohm) Llr'(H)]: [1.395 0.005839]

Mutual inductance Lm (H): 0.1722

Inertia, friction factor, pole pairs [J(kg.m^2) F(N.m.s) p()]: [0.0131 0.002985 2]

Initial conditions
[slip, th(deg), ia,ib,ic(A), pha,phb,phc(deg)]:
[0 0 0 0 0 0]

☐ Simulate saturation Plot

[i(Arms) ; v(VLL rms)]: [302.9841135, 428.7778367 ; 230, 322, 414, 460, 506, 552, 598, 644, 690]

OK Cancel Help Apply

Block Parameters: Asynchronous Machine SI Units

Asynchronous Machine (mask) (link)
Implements a three-phase asynchronous machine (wound rotor, squirrel cage or double squirrel cage) modeled in a selectable dq reference frame (rotor, stator, or synchronous). Stator and rotor windings are connected in wye to an internal neutral point.

Configuration Parameters Load Flow

Rotor type:
Squirrel-cage

Preset parameters
Squirrel-cage preset model: No
Double squirrel-cage preset model: Open parameter estimator

Mechanical input:
Torque Tm

Reference frame:
Rotor

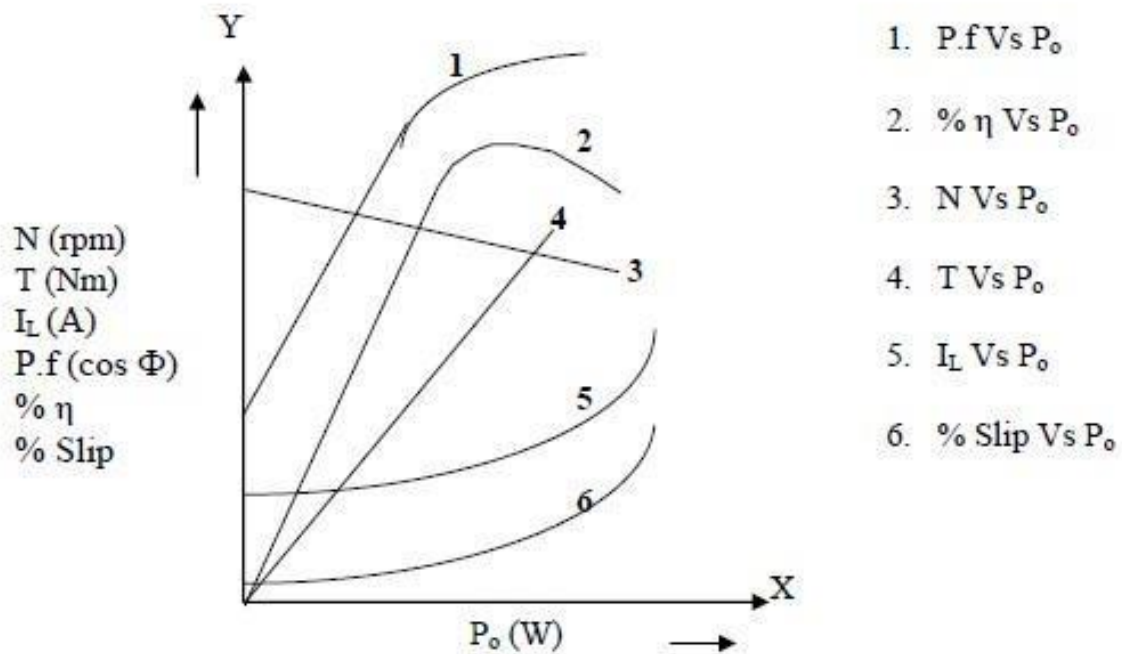
Measurement output
☐ Use signal names to identify bus labels

OK Cancel Help Apply

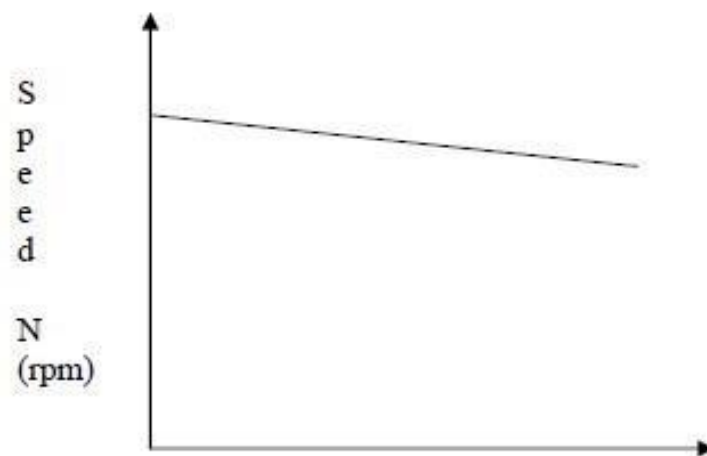
Characteristic Curves -

Theoretical -

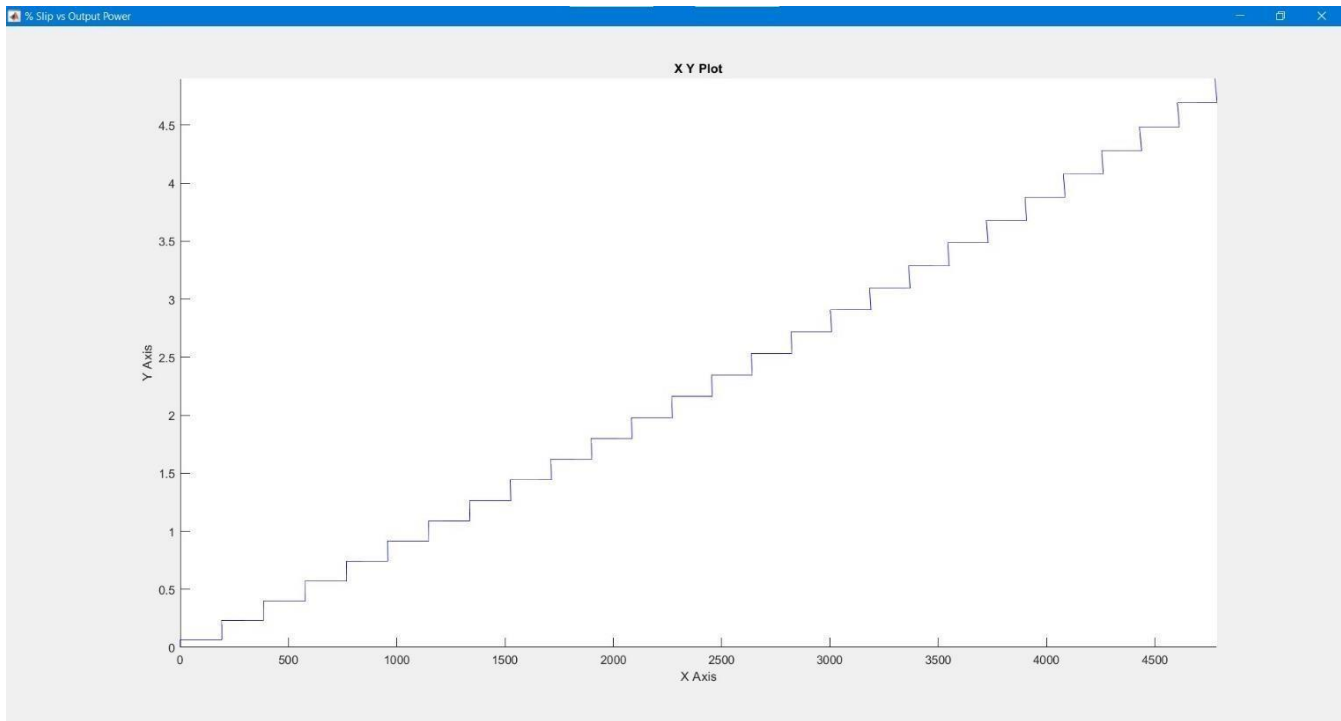
PERFORMANCE CHARACTERISTICS



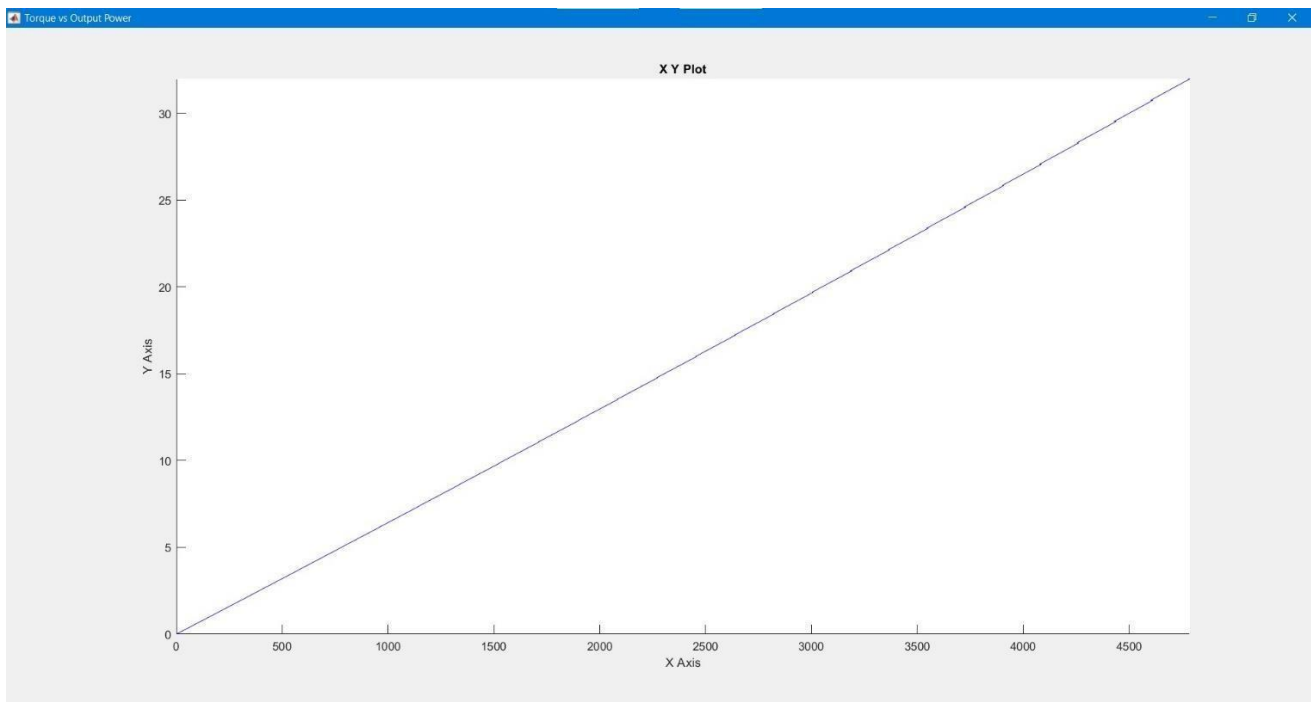
SPEED Vs TORQUE

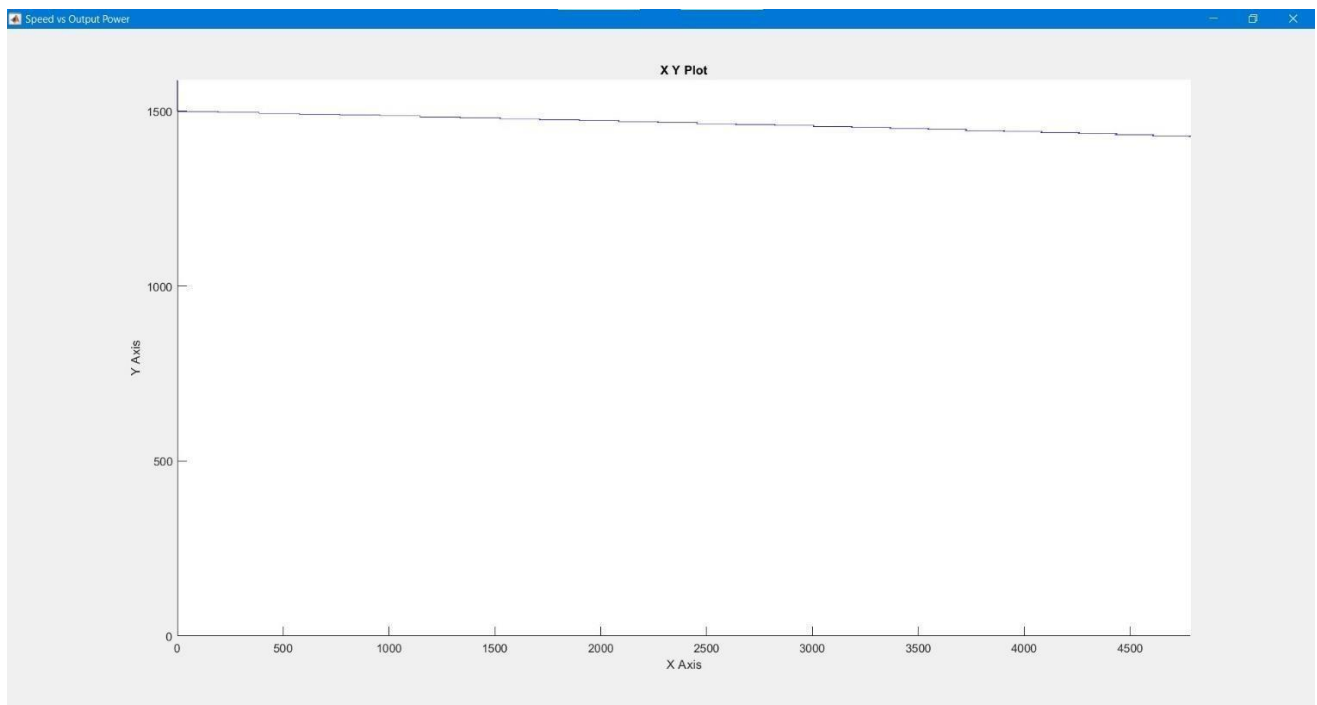
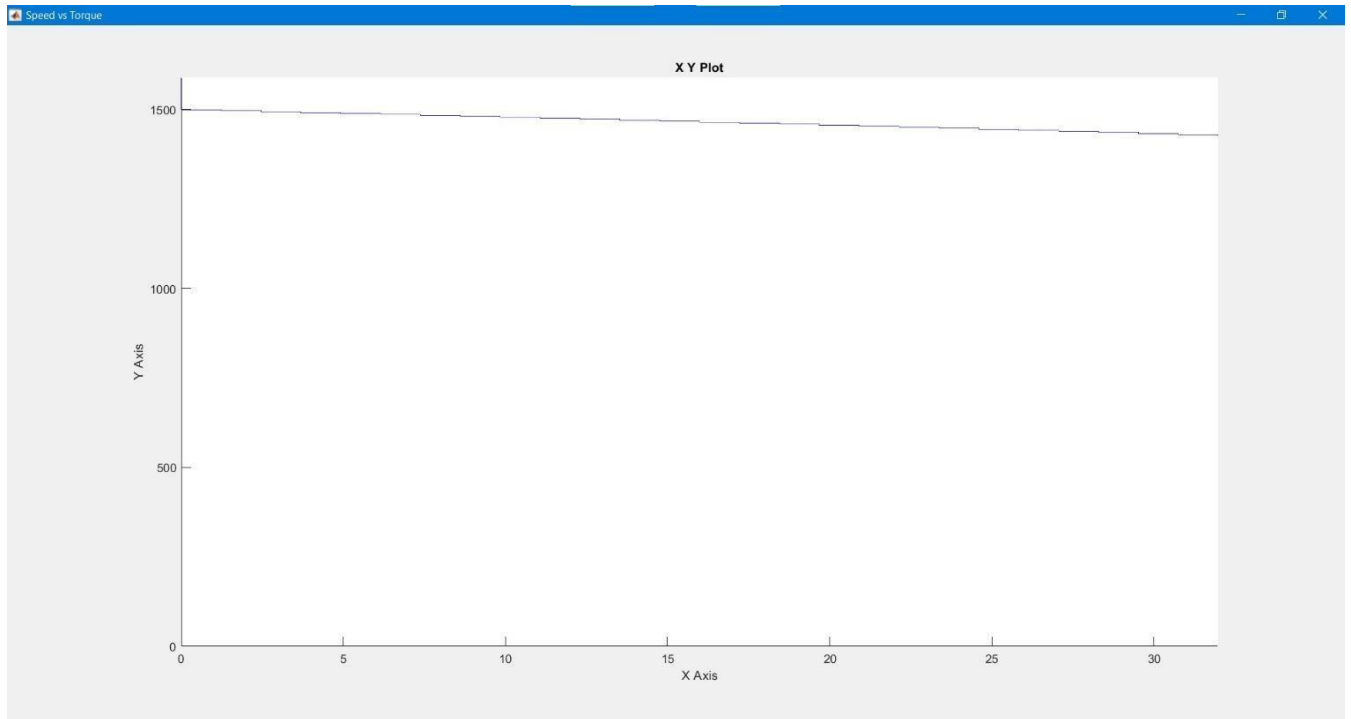


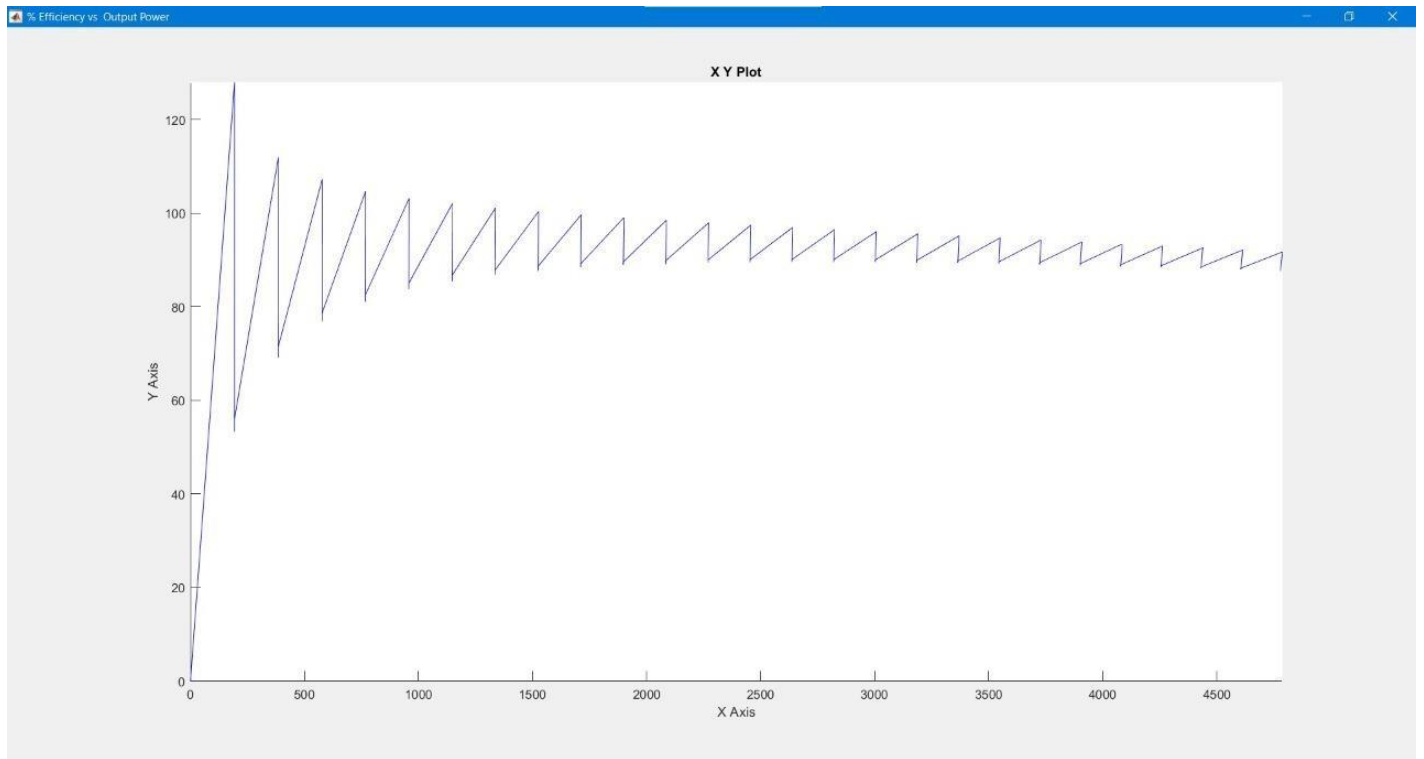
Simulated -



Full load slip=4.902%







Inference -

Power Factor vs Output Power -

1. As can be observed, the power factor curve demonstrates a linear nature but then it follows a curved path.
2. Power factor of induction motor on NO-LOAD is very low because of the high value of magnetizing current. With the increase in load the power factor increases because the power component of the current is increased. Low power factor operation is one of the disadvantages of induction motor. An induction motor draws heavy amount of magnetizing current due to presence of air gap between the stator and rotor. Thus, to reduce the magnetizing current in induction motor the air-gap is kept as small as possible.
3. Input power factor can also be calculated from the readings of two wattmeters for balanced load.
4. When the induction motor is on NO-LOAD speed is slightly below the synchronous speed. The current due to induced emf in the rotor winding is responsible for production of torque required at NO-LOAD. As the load is increased the rotor speed is slightly reduced. The emf induced in the rotor causes a surge in current to produce higher torque, until the torque developed is equal to torque required by load on motor.

Speed vs Torque -

1. The said curve follows a linear nature having a negative slope.
2. The marginal drop in speed (~2-5%) happens as we load the machine from zero (No load) to maximum (Full load).
3. The load torque is dependent on the load connected to the shaft. As the load increases then the electromagnetic torque (responsible for the shaft rotational speed) decreases as well as speed decreases. This can be derived by the formula

$$P = \omega \tau$$

Power is always same for constant power operation. So, if the load torque increases the speed decreases and vice versa.

In this way speed of the motor decreases with the increasing of load in rotor shaft.

Dichotomy -

Simulation	Practical
<ol style="list-style-type: none"> 1. Being an ideal machine, the term “rated power” is irrelevant as there are no limits to amount of current it can withstand. 2. Simulation proves to be a much more efficient method of application 3. Efficiency is better since there are no stray losses. $\eta = 95\%$ 4. Virtually no errors. 5. Energy efficient since only a computer is run. 6. Risks during a simulation are irrelevant. 	<ol style="list-style-type: none"> 1. The rated power is a constant value calculated according to the rated current and voltage. 2. Practical experiment takes a lot of time and money to be implemented. 3. Factors such as windage losses, frictional losses depreciate efficiency. $\eta = 87\%$ 4. Human error plays a role. 5. An induction motor consumes heavy wattage. 6. Running a loaded induction machine comes along with chances of being electrocuted.