Annexure

Matlab Programs are as below:

Program B1

[1] This Program calculates Parameters of equivalent circuit of Induction motor.
[2] This Program is for Star connected motor.
[3] Substitute line value of voltage and current and three phase power.

Input Parameters

V0(Capital V and zero) =No load line to line voltage;
I0(Capital I and zero)= No load line current;
P0(Capital P and zero)= No load 3-phase power input;
N0(Capital N and zero)= No load speed;
Vb(Capital V and small b)= Blocked rotor line to line voltage;
Ib(Capital I and small b)= Blocked rotor line current;
Pb(Capital P and small b)= Blocked rotor 3-phase power input;
Rdc(Capital R and small dc)=DC resistance per phase;

Program for execution

```
disp('[1] This Program calculates Parameters of equivalent circuit of Induction
motor.')
disp('[2] This Program is for Star connected motor.')
disp('[3] Substitute line value of voltage and current and three phase power.')
disp('* Input Parameters.')
V0=415;
I0=0.64;
P0=50;
N0=2980;
Vb=200;
Ib=1.3;
Pb=165;
Rdc=20.95;
disp(['No Load Voltage (V):',num2str(V0)])
disp(['No Load Current (A):',num2str(I0)])
disp(['No Load Input Power (W):',num2str(P0)])
disp(['No Load Speed (RPM):',num2str(N0)])
disp(['Blocked Rotor Voltage (V):',num2str(Vb)])
disp(['Blocked Rotor Current (A):',num2str(Ib)])
disp(['Blocked Rotor Input Power (W):',num2str(Pb)])
disp('*Calculated Parameters:')
PF0=(P0/(1.732*V0*I0));
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```
disp(['No Load PF :',num2str(PF0)])
PFb=(Pb/(1.732*Vb*Ib));
disp(['Blocked Rotor PF :',num2str(PFb)])
phy0=acos(PF0);
phyb=acos(PFb);
disp(['PF angle in No Load condition (rad) :',num2str(phy0)])
disp(['PF angle in Blocked Rotor Condition (rad) :',num2str(phyb)])
Iw=I0*cos(phy0);
Im=I0*sin(phy0);
RFEs=V0/(sqrt(3)*Iw);
Xm=V0/(sqrt(3)*Im);
Zsc=Vb/(sqrt(3)*Ib);
R01s=Pb/(3*(Ib)^2);
X01=sqrt((Zsc)^2-(R01s)^2);
X1=X01/2;
X2=X01/2;
disp('Following steps will correct resistance from 32 to 75 deg. centigrade')
R1=(Rdc*(95+234.5))/(32+234.5);
R01=(R01s*(95+234.5))/(32+234.5);
R2=R01-R1;
RFE=(RFEs*(95+234.5))/(32+234.5);
disp(['Motor Resistance referred to stator R01(ohm) :',num2str(R01)])
disp(['Motor leakage reactance X01 (ohm) :',num2str(X01)])
disp(['Stator Resistance R1(ohm) :',num2str(R1)])
disp(['Stator Reactance X1(ohm) :',num2str(X1)])
disp(['Magnetizing branch Resistance RFE(ohm) :',num2str(RFE)])
disp(['Magnetizing branch reactance Xm (ohm) :',num2str(Xm)])
disp(['Rotor Resistance referred to stator R2(ohm) :',num2str(R2)])
disp(['Rotor Reactance referred to stator X2(ohm) :',num2str(X2)])
```

Program B2

```
disp('[1] This Program calculates Performance Induction motor from equivalent
circuit parameters.')
disp('[2] Substitute phase value of parameters.')
disp('[3] Units: Voltages in Volts, Currents in Amp., Power in Watts.')
disp('Resistances, Reactances, Impedances are in Ohm and Angle in Radians.')
disp('Torque in Nm.')
disp('*Input Data.')
V1=239.61;
F=50;
P=2;
R1=25.9025;
X1=41.3231;
R2=14.3353;
X2=41.3231;
Rfe=4258.64;
Xm=376.6067;
s=0.05;
FW=15;
disp(['Stator voltage per phase V1 = :',num2str(V1)])
disp(['Frequency of Supply voltage V1 = :',num2str(F)])
disp(['Number of poles of the motor = :',num2str(P)])
disp(['Rsistance of stator per phase R1 = :',num2str(R1)])
disp(['Reactance of stator per phase X1 = :',num2str(X1)])
disp(['Rsistance of rotor per phase R2 = :',num2str(R2)])
disp(['Reactance of rotor per phase X2 = :',num2str(X2)])
disp(['Magnetizing branch Rsistance per phase Rfe = :',num2str(Rfe)])
disp(['Magnetizing branch Reactance per phase Xm = :',num2str(Xm)])
disp(['Friction and Windage loss (totaL)FW = :',num2str(FW)])

disp('*Program for Stator current,rotor current, PF.')
disp('*Program for Output power, Input power and efficiency.')

Ns=(120*F)/P;
Z1=[R1,X1];
Z2=[R2,X2];
ZT=Z1+Z2;
disp(['Impedance of stator per phase Z1 = :',num2str(Z1)])
disp(['Impedance of rotor per phase Z2=:',num2str(Z2)])
disp(['Impedance (Cartesian) of the motor per phase ZT = :',num2str(ZT)])
[THETA,RHO]=cart2pol((R1+R2),(X1+X2));
disp(['Magnitude of the motor Impedance per phase ZT in Polar form
=:',num2str(RHO)])
disp(['Angle Motor impedance ZT in Polar form =:',num2str(THETA)])
Iw=V1/Rfe;
Im=V1/Xm;
disp(['Performance of motor at slip = :',num2str(s)])
RL=R2*((1/s)-1);
```

```
ZL=[R1+R2+RL X1+X2];
[THETAL,RHOL]=cart2pol((R1+R2+RL),(X1+X2));
I2p=V1/RHOL;
disp(['Rotor Current (Polar)per phase I2p = :',num2str(I2p)])
disp(['PF angle of Rotor Current = :',num2str(THETA)])
I2a=I2p*cos(THETAL);
I2r=I2p*sin(THETAL);
I2=[I2a I2r];
I1=[Iw+I2a Im+I2r];
[THETA1,RHO1]=cart2pol((Iw+I2a),(Im+I2r));
PF=cos(THETA1);
disp(['Current (Cartesian) of the rotor per phase I2 = :',num2str(I2)])
disp(['Current (Cartesian) of the Motor per phase I1 = :',num2str(I1)])
disp(['Magnitude of the motor Current per phase I1 in Polar form
=:',num2str(RHO1)])
disp(['PF Angle of Motor Current I1 =:',num2str(THETA1)])
disp(['Power factor of the motor  =:',num2str(PF)])
N=Ns*(1-s);
disp(['Speed in RPM  =:',num2str(N)])
Pout=((3*(I2p)^2*RL)-FW);
disp(['Output of the Motor =:',num2str(Pout)])
Ts=(60/(2*pi*N))*Pout;
disp(['Torque developed by the motor at slip s Ts =:',num2str(Ts)])
Pin=(3*V1*RHO1*PF);
disp(['Input to the Motor =:',num2str(Pin)])
Eff=100*(Pout/Pin);
disp(['Efficiency of the Motor =:',num2str(Eff)])

disp('Program for maximum gross Power output:')

Pmax=3*(V1^2/(2*(R1+R2+RHO)));
disp(['Maximum gross Power output=:',num2str(Pmax)])

disp('Program for Starting torque developed by the motor at Normal voltage')

IbrN=V1/RHO;
disp(['Blocked rotor current at Normal Voltage=:',num2str(IbrN)])
Pinr=(3*IbrN^2*R2);
disp(['Blocked rotor Power input to rotor at Normal Voltage (Syn
watts)=:',num2str(Pinr)])
Pinm=3*V1*IbrN*cos(THETA);
disp(['Blocked rotor Power input to motor at Normal Voltage=:',num2str(Pinm)])
Tst=(60/(2*pi*Ns))*Pinr;
disp(['Starting gross torque developed by the motor at Normal
voltage=:',num2str(Tst)])

disp('Program for maximum torque developed by the motor at Normal voltage')
```

```
disp('from rotor circuit')
sm=R2/X2;
RLm=R2*((1/sm)-1);
ZLm=[R1+R2+RLm X1+X2];
[THETAL2,RHOL2]=cart2pol((R1+R2+RLm),(X1+X2));
I2pm=V1/RHOL2;
disp(['Rotor current at maximum torque =:',num2str(I2pm)])
Pcum=(3*I2pm^2*R2);
disp(['Rotor cu loss at maximum torque =:',num2str(Pcum)])
Pinm=Pcum/sm;
disp(['Rotor input at maximum torque =:',num2str(Pinm)])
disp(['Slip corresponds to maximum torque sm =:',num2str(sm)])
Tm=(60/(2*pi*Ns))*Pinm;
disp(['Maximum gross torque developed by the motor Tm =:',num2str(Tm)])

disp('Program for maximum torque developed by the motor at Normal voltage')
disp('from equivalent circuit')

sm1=R2/(sqrt(R1^2+(X1+X2)^2));
disp(['Slip corresponds to maximum torque sm1 =:',num2str(sm1)])
Wms=4*pi*F/P;
Tm1=(3/(2*Wms))*(V1^2/(R1+(sqrt(R1^2+(X1+X2)^2))));
disp(['Maximum torque Tm1 =:',num2str(Tm1)])
```

Program B3

```
disp('This program draws Speed-Torque characteristic for rated')
disp('value of supply voltage and frequency.')
V1=239.61;
F=50;
P=2;
R1=25.9025;
X1=41.3231;
R2=14.3353;
X2=41.3231;
Rfe=4258.64;
Xm=376.60;
ns=(2*F)/P;
for s=0:0.001:1
n=(1-s);
Tg=(3/(2*pi*ns))*((V1^2*R2/s)/((R1+(R2/s))^2+(X1+X2)^2));
TL=1.5*(1-s)^2;
disp(['The values of n:', num2str(n)])
disp(['The values of Tg : ', num2str(Tg)])

text(0.1,1.2,'Tg')
text(0.4,0.4,'TL')
XLABEL('Speed'), YLABEL('Torque (Nm)')
plot(n,Tg,n,TL)
hold on
end
```

Program B4

```
disp('This program draws Speed-Torque characteristic for different')
disp('values of supply voltage and rated frequency.')
V1=239.61;
F=50;
P=2;
V2=0.78*V1;
V3=0.6*V1;
R1=25.9025;
R2=14.3353;
X1=41.3231;
X2=41.3231;
ns=(2*F)/P;
for s=0:0.001:1
n=(1-s);
T1=(3/(2*pi*ns))*((V1^2*R2/s)/((R1+(R2/s))^2+(X1+X2)^2));
T2=(3/(2*pi*ns))*((V2^2*R2/s)/((R1+(R2/s))^2+(X1+X2)^2));
T3=(3/(2*pi*ns))*((V3^2*R2/s)/((R1+(R2/s))^2+(X1+X2)^2));
TL=1.2*((1-s)^2);
disp(['The values of n:', num2str(n)])
disp(['The values of T1 : ', num2str(T1)])
disp(['The values of T2:', num2str(T2)])
disp(['The values of T3 : ', num2str(T3)])

text(0.75,2.2,'100% V')
text(0.75,1.4,'78% V')
text(0.8,0.7,'60% V')
text(0.4,0.25,'TL')
XLABEL('Speed (PU)'), YLABEL('Torque (Nm)')
plot(n,T1,n,T2,n,T3,n,TL)
hold on
end
```

Program B5

```
disp('This Program draws Speed-Torque Characteristic for variable values')
disp('voltage and frequency i.e.constant V/f.')
V1=239.61;
V2=0.8*V1;
F1=50;
F2=0.8*F1;
P=2;
R1=25.9025;
R2=14.3353;
X1=41.3231;
X2=41.3231;
X3=33.058;
X4=33.058;
ns1=(2*F1)/P;
ns2=(2*F2)/P;
for s=0.001:0.001:1
n1=(1-s)*ns1;
T1=(3/(2*pi*ns1))*((V1^2*R2/s)/((R1+(R2/s))^2+(X1+X2)^2));
n2=(1-s)*ns2;
T2=(3/(2*pi*ns2))*((V2^2*R2/s)/((R1+(R2/s))^2+(X3+X4)^2));
disp(['The values of n1:', num2str(n1)])
disp(['The values of T1 : ', num2str(T1)])
disp(['The values of n2:', num2str(n2)])
disp(['The values of T2 : ', num2str(T2)])

text(40,2,'50 Hz')
text(30,2,'40 Hz')


XLABEL('Speed (RPS)'), YLABEL('Torque (Nm)')
plot(n1,T1,n2,T2)
hold on
end
```

Program B6

```
disp('[1] This Program draws Performance curves of an Induction motor')
disp('from equivalent circuit parameters.')
disp('[2] Substitute phase value of parameters.')
disp('[3] Units: Voltages in Volts, Currents in Amp., Power in Watts.')
disp('Resistances, Reactances, Impedances are in Ohm and Angle in Radians.')
disp('Torque in Nm.')
disp('*These datas are for 470 W, 415 V,1.3 A,3-ph, 50 Hz, Frame 63')
disp('Class F, Star connected I.M.')
disp('*Input Data.')
V1=239.61;
F=50;
P=2;
R1=25.9025;
X1=41.3231;
R2=14.3353;
X2=41.3231;
Rfe=4258.64;
Xm=376.6067;

FW=15;
disp(['Stator voltage per phase V1 = :',num2str(V1)])
disp(['Frequency of Supply voltage V1 = :',num2str(F)])
disp(['Number of poles of the motor = :',num2str(P)])
disp(['Rsistance of stator per phase R1 = :',num2str(R1)])
disp(['Reactance of stator per phase X1 = :',num2str(X1)])
disp(['Rsistance of rotor per phase R2 = :',num2str(R2)])
disp(['Reactance of rotor per phase X2 = :',num2str(X2)])
disp(['Magnetizing branch Rsistance per phase Rfe = :',num2str(Rfe)])
disp(['Magnetizing branch Reactance per phase Xm = :',num2str(Xm)])
disp(['Friction and Windage loss (totaL)FW = :',num2str(FW)])

disp('*Program for Stator current,rotor current, PF.')
disp('*Program for Output power, Input power and efficiency.')

Ns=(120*F)/P;
Z1=[R1,X1];
Z2=[R2,X2];
ZT=Z1+Z2;
disp(['Impedance of stator per phase Z1 = :',num2str(Z1)])
disp(['Impedance of rotor per phase Z2= :',num2str(Z2)])
disp(['Impedance (Cartesian) of the motor per phase ZT = :',num2str(ZT)])
[THETA,RHO]=cart2pol((R1+R2),(X1+X2));
disp(['Magnitude of the motor Impedance per phase ZT in Polar form
=:',num2str(RHO)])
disp(['Angle Motor impedance ZT in Polar form =:',num2str(THETA)])
Iw=V1/Rfe;
Im=V1/Xm;
```

```
for s=0.004:0.0001:0.06
RL=R2*((1/s)-1);
ZL=[R1+R2+RL X1+X2];
[THETAL,RHOL]=cart2pol((R1+R2+RL),(X1+X2));
I2p=V1/RHOL;
disp(['Rotor Current (Polar)per phase I2p = :',num2str(I2p)])
disp(['PF angle of Rotor Current = :',num2str(THETA)])
I2a=I2p*cos(THETAL);
I2r=I2p*sin(THETAL);
I2=[I2a I2r];
I1=[Iw+I2a Im+I2r];
[THETA1,RHO1]=cart2pol((Iw+I2a),(Im+I2r));
PF=cos(THETA1);
disp(['Current (Cartesian) of the rotor per phase I2 = :',num2str(I2)])
disp(['Current (Cartesian) of the Motor per phase I1 = :',num2str(I1)])
disp(['PF Angle of Motor Current I1 =:',num2str(THETA1)])
disp('Result')
disp(['Magnitude of the motor Current per phase I1 in Polar form
=:',num2str(RHO1)])
disp(['Power factor of the motor  =:',num2str(PF)])
N=Ns*(1-s);
disp(['Speed in RPM  =:',num2str(N)])
Pout=((3*(I2p)^2*RL)-FW);
disp(['Output of the Motor =:',num2str(Pout)])
Pin=(3*V1*RHO1*PF);
disp(['Input to the Motor =:',num2str(Pin)])
Eff=100*(Pout/Pin);
disp(['Efficiency of the Motor =:',num2str(Eff)])
XLABEL('Output (Watts)'),YLABEL('Efficiency')
plot(Pout,Eff)

text(100,50,'Efficiency')

hold on
end
```

Program B7

```
disp('[1] This Program draws Performance curves of an Induction motor')
disp('from equivalent circuit parameters.')
disp('[2] Substitute phase value of parameters.')
disp('[3] Units: Voltages in Volts, Currents in Amp., Power in Watts.')
disp('Resistances, Reactances, Impedances are in Ohm and Angle in Radians.')
disp('Torque in Nm.')
disp('*These datas are for 470 W,415 V, 1.3 A, 3-ph, 50 Hz,Class E ')
disp('Frame 63, Star connected I.M.')
disp('*Input Data.')
V1=239.61;
F=50;
P=2;
R1=25.9025;
X1=41.3231;
R2=14.3353;
X2=41.3231;
Rfe=4258.64;
Xm=376.6067;
FW=15;
disp(['Stator voltage per phase V1 = :',num2str(V1)])
disp(['Frequency of Supply voltage V1 = :',num2str(F)])
disp(['Number of poles of the motor = :',num2str(P)])
disp(['Rsistance of stator per phase R1 = :',num2str(R1)])
disp(['Reactance of stator per phase X1 = :',num2str(X1)])
disp(['Rsistance of rotor per phase R2 = :',num2str(R2)])
disp(['Reactance of rotor per phase X2 = :',num2str(X2)])
disp(['Magnetizing branch Rsistance per phase Rfe = :',num2str(Rfe)])
disp(['Magnetizing branch Reactance per phase Xm = :',num2str(Xm)])
disp(['Friction and Windage loss (totaL)FW = :',num2str(FW)])

disp('*Program for Stator current,rotor current, PF.')
disp('*Program for Output power, Input power and efficiency.')

Ns=(120*F)/P;
Z1=[R1,X1];
Z2=[R2,X2];
ZT=Z1+Z2;
[THETA,RHO]=cart2pol((R1+R2),(X1+X2));
Iw=V1/Rfe;
Im=V1/Xm;
for s=0.004:0.0001:0.06
RL=R2*((1/s)-1);
ZL=[R1+R2+RL X1+X2];
[THETAL,RHOL]=cart2pol((R1+R2+RL),(X1+X2));
I2p=V1/RHOL;
I2a=I2p*cos(THETAL);
I2r=I2p*sin(THETAL);
```

```
I2=[I2a I2r];
I1=[Iw+I2a Im+I2r];
[THETA1,RHO1]=cart2pol((Iw+I2a),(Im+I2r));
PF=cos(THETA1);
N=Ns*(1-s);
disp(['Speed in RPM =:',num2str(N)])
Pout=((3*(I2p)^2*RL)-FW);
disp(['Output of the Motor =:',num2str(Pout)])
Pin=(3*V1*RHO1*PF);
disp(['Input to the Motor =:',num2str(Pin)])
Eff=100*(Pout/Pin);
disp(['Efficiency of the Motor =:',num2str(Eff)])
XLABEL('Output(Watts)'),YLABEL('Current, Power Factor')

plot(Pout,RHO1,Pout,PF)
text(250,1.0,'Current')
text(150,0.55,'Power Factor')

hold on
end
```

Program B8

```
disp('[1] This Program draws Performance curves of an Induction motor')
disp('from equivalent circuit parameters.')
disp('[2] Substitute phase value of parameters.')
disp('[3] Units: Voltages in Volts, Currents in Amp., Power in Watts.')
disp('Resistances, Reactances, Impedances are in Ohm and Angle in Radians.')
disp('Torque in Nm.')
disp('*These datas are for 470 W,415 V, 1.3 A, 3-ph, 50 Hz,Class E ')
disp('Frame 63, Star connected I.M.')
disp('*Input Data.')
V1=239.61;
F=50;
P=2;
R1=25.9025;
X1=41.3231;
R2=14.3353;
X2=41.3231;
Rfe=4258.64;
Xm=376.6064;
FW=15;
disp(['Stator voltage per phase V1 = :',num2str(V1)])
disp(['Frequency of Supply voltage V1 = :',num2str(F)])
disp(['Number of poles of the motor = :',num2str(P)])
disp(['Rsistance of stator per phase R1 = :',num2str(R1)])
disp(['Reactance of stator per phase X1 = :',num2str(X1)])
disp(['Rsistance of rotor per phase R2 = :',num2str(R2)])
disp(['Reactance of rotor per phase X2 = :',num2str(X2)])
disp(['Magnetizing branch Rsistance per phase Rfe = :',num2str(Rfe)])
disp(['Magnetizing branch Reactance per phase Xm = :',num2str(Xm)])
disp(['Friction and Windage loss (totaL)FW = :',num2str(FW)])

disp('*Program for Stator current,rotor current, PF.')
disp('*Program for Output power, Input power and efficiency.')

Ns=(120*F)/P;
Z1=[R1,X1];
Z2=[R2,X2];
ZT=Z1+Z2;
[THETA,RHO]=cart2pol((R1+R2),(X1+X2));
Iw=V1/Rfe;
Im=V1/Xm;
C=100;
D=1000;
for s=0.004:0.0001:0.06
RL=R2*((1/s)-1);
ZL=[R1+R2+RL X1+X2];
[THETAL,RHOL]=cart2pol((R1+R2+RL),(X1+X2));
I2p=V1/RHOL;
```

```
I2a=I2p*cos(THETAL);
I2r=I2p*sin(THETAL);
I2=[I2a I2r];
I1=[Iw+I2a Im+I2r];
[THETA1,RHO1]=cart2pol((Iw+I2a),(Im+I2r));
PF=cos(THETA1);
N=Ns*(1-s);
disp(['Speed in RPM  =:',num2str(N)])
Pout=((3*(I2p)^2*RL)-FW);
disp(['Output of the Motor =:',num2str(Pout)])
Pin=(3*V1*RHO1*PF);
disp(['Input to the Motor =:',num2str(Pin)])
Eff=100*(Pout/Pin);
disp(['Efficiency of the Motor =:',num2str(Eff)])
XLABEL('Output(Watts)'),YLABEL('Speed(RPM)')

plot(Pout,N)
plot(C,D)

text(150,2750,'Speed')


hold on
end
```

Program B9

```
disp('[1] This Program draws Performance curves of an Induction motor')
disp('from equivalent circuit parameters.')
disp('[2] Substitute phase value of parameters.')
disp('[3] Units: Voltage in Volts, Current in Amp., Power in Watt.')
disp('Resistances, Reactances, Impedances are in Ohm and Angle in Radians.')
disp('Torque in Nm.')
disp('*These data are for 470 W, 415 V, 1.3 A, 3-ph, 50 Hz, Frame 63')
disp('Class F, Star connected I.M.')
disp('*Input Data.')
V1=239.61;
F=50;
P=2;
R1=25.9025;
X1=41.3231;
R2=14.3353;
X2=41.3231;
Rfe=4258.64;
Xm=376.6067;

FW=15;
disp(['Stator voltage per phase V1 = :',num2str(V1)])
disp(['Frequency of Supply voltage V1 = :',num2str(F)])
disp(['Number of poles of the motor = :',num2str(P)])
disp(['Resistance of stator per phase R1 = :',num2str(R1)])
disp(['Reactance of stator per phase X1 = :',num2str(X1)])
disp(['Resistance of rotor per phase R2 = :',num2str(R2)])
disp(['Reactance of rotor per phase X2 = :',num2str(X2)])
disp(['Magnetizing branch Rsistance per phase Rfe = :',num2str(Rfe)])
disp(['Magnetizing branch Reactance per phase Xm = :',num2str(Xm)])
disp(['Friction and Windage loss (total) FW = :',num2str(FW)])

disp('*Program for Stator current,rotor current, PF.')
disp('*Program for Output power, Input power and efficiency.')

Ns=(120*F)/P;
Z1=[R1,X1];
Z2=[R2,X2];
ZT=Z1+Z2;
disp(['Impedance of stator per phase Z1 = :',num2str(Z1)])
disp(['Impedance of rotor per phase Z2= :',num2str(Z2)])
disp(['Impedance (Cartesian) of the motor per phase ZT = :',num2str(ZT)])
[THETA,RHO]=cart2pol((R1+R2),(X1+X2));
disp(['Magnitude of the motor Impedance per phase ZT in Polar form
=:',num2str(RHO)])
disp(['Angle Motor impedance ZT in Polar form =:',num2str(THETA)])
Iw=V1/Rfe;
Im=V1/Xm;
```

```
for s=0.082:0.0001:0.086
RL=R2*((1/s)-1);
ZL=[R1+R2+RL X1+X2];
[THETAL,RHOL]=cart2pol((R1+R2+RL),(X1+X2));
I2p=V1/RHOL;

I2a=I2p*cos(THETAL);
I2r=I2p*sin(THETAL);
I2=[I2a I2r];
I1=[Iw+I2a Im+I2r];
[THETA1,RHO1]=cart2pol((Iw+I2a),(Im+I2r));
PF=cos(THETA1);

N=Ns*(1-s);
RCU=3*(I2p)^2*R2;
Pout=((3*(I2p)^2*RL)-FW);

Pin=(3*V1*RHO1*PF);

Eff=100*(Pout/Pin);
w=(2*pi*N)/60;
Tm=(Pout/w);
disp(['[1]Slip =:',num2str(s)])
disp(['[2]Output of the Motor (W) =:',num2str(Pout)])
disp(['[3]Input to the Motor (W) =:',num2str(Pin)])
disp(['[4]Motor Current per phase I1 (A) =:',num2str(RHO1)])
disp(['[5]Power factor =:',num2str(PF)])
disp(['[6]Speed (RPM)  =:',num2str(N)])
disp(['[7]Torque Tm (Nm) =:',num2str(Tm)])
disp(['[8]Efficiency =:',num2str(Eff)])
disp(['[9]Rotor cu loss =:',num2str(RCU)])
disp(['[10]Rotor current =:',num2str(I2p)])
disp('**')
disp('**')
disp('**')
disp('**')
XLABEL('Output (Watts)'),YLABEL('Torque (Nm)')

plot(Pout,Tm)

text(200,1.0,'Torque')

hold on
end
```

Program B10

```
disp('Program for calculating Voltage transient at Motor Terminals')
disp('L, C, R are the cable Parameters, V is dc link voltage')
V=415;
L=0.1;
C=0.005;
R=0.2;
w=sqrt(L/C);
T=(2*L)/R;
for t=0:0.01:4
y=(V*(1-exp(-t)/T)*cos(w*t));
disp(['The values of t:', num2str(t)])
disp(['The values of y : ', num2str(y)])
plot(t,y)
hold on
end
```