Annexure:

1. MATLAB code for LPC

```
[x,fs]=wavread ('v6f_silence_rem.wav');      % get a SPECCH SIGNAL……
x=resample (x,10000,fs);                     % resample to 10,000Hz (optional)
fs=10000;          t=(0:length(x)-1)/fs;     % times of sampling instants
subplot(2,1,1);          plot(t,x);
legend('Waveform');                          % plot waveform
xlabel('Time (s)');      ylabel('Amplitude'); % get Linear prediction filter
ncoeff=2+fs/1000;                            % rule of thumb for formant estimation
a=lpc(x,ncoeff);         [h,f]=freqz(1,a,512,fs);   % plot frequency response
subplot(2,1,2);                plot(f,20*log10(abs(h)+eps));
legend('LP Filter');     xlabel('Frequency (Hz)');      ylabel('Gain (dB)');
%%%%Calculation part -- find frequencies by root-solving
r=roots(a);                                  % find roots of polynomial a
r=r(imag(r)>0.01);                           % only look for roots >0Hz up to fs/2
ffreq=sort(atan2(imag(r),real(r))*fs/(2*pi)); %convert to Hz & sort
for i=1:length(ffreq)
fprintf('Formant %d Frequency %.1f\n',i,ffreq(i));
end
```

1. MATLAB code for MFCC

```
fileID = fopen('aw_female.txt','w');
x=wavread('D:\database\FEMALE DATA\VOWEL\F1\v6f.wav');
x=x/max(abs(x));
for frame=1:12
```

```
p1=(frame-1)*256+1; y=x(p1:p1+255);        y=y/max(abs(y));
a=lpc(y,10);              x1(frame,:)=a;          c(frame,1)=real(a(2));
for n=2:10       s=0;
for m=1:n-1               s=s+m*a(m+1)*c(frame,n-m);          end;
c(frame,n)=real(a(n+1)+s/n);              end;
for n=11:20               s=0;
for m=1:10                s=s+(n-m)*a(m+1)*c(frame,n-m);      end;
c(frame,n)=real(s/n);                     end;
disp(strcat(' MFCC value for frame.',num2str(frame)));
fprintf(fileID,'%6s%6s\n','Value of MFCC for frame:', num2str(frame));
disp(' ');                disp(' ');          disp(c(frame,:));         fprintf(fileID,'%4.2f
\t',c(frame,:));  fprintf(fileID,'\n \n \n ');          hold on;          subplot(3,4,frame);
%p:=subplot::(3,4,frame); %p::LineColor :=RGB::blue  %delete p;
plot(real(c(frame,:)), 'b','LineWidth',5);          title('          MFCC  Bodo  vowel  /aw/');
legend('MFCC');          xlabel('Cepstral   Coefficients');   label('LogMagnitude(dB)');
end;
fclose(fileID); fileID = fopen('aw_female.txt','w');
x=wavread('D:\database\FEMALE DATA\VOWEL\F1\v6f.wav');  x=x/max(abs(x));
for frame=1:12            p1=(frame-1)*250+1; y=x(p1:p1+249);        y=y/max(abs(y));
a=lpc(y,10);     x1(frame,:)=a;           c(frame,1)=real(a(2));
for n=2:10                        s=0;
for m=1:n-1               s=s+m*a(m+1)*c(frame,n-m);          end;
c(frame,n)=real(a(n+1)+s/n);              end;
for n=11:20               s=0;
for m=1:10                s=s+(n-m)*a(m+1)*c(frame,n-m);      end;
```

```
c(frame,n)=real(s/n);
end;
disp(strcat('MFCC value for frame.',num2str(frame)));
fprintf(fileID,'%6s%6s\n','Value of MFCC for frame:',num2str (frame));
disp(' ');          disp(' ');          disp(c(frame,:));          %disp(c(frame,:));
fprintf(fileID,'%4.2f \t',c(frame,:));    fprintf(fileID,'\n \n \n ');
%fprintf(fileID,'%6s\n\n\n ','XXX');
hold on;              subplot(3,4,frame);
plot(real(c(frame,:)), 'g','LineWidth',5);
title('     MFCC of Bodo vowel /aw/');
xlabel('Cepstral Coefficients');          ylabel('LogMagnitude(dB)');  end;
fclose(fileID);
```