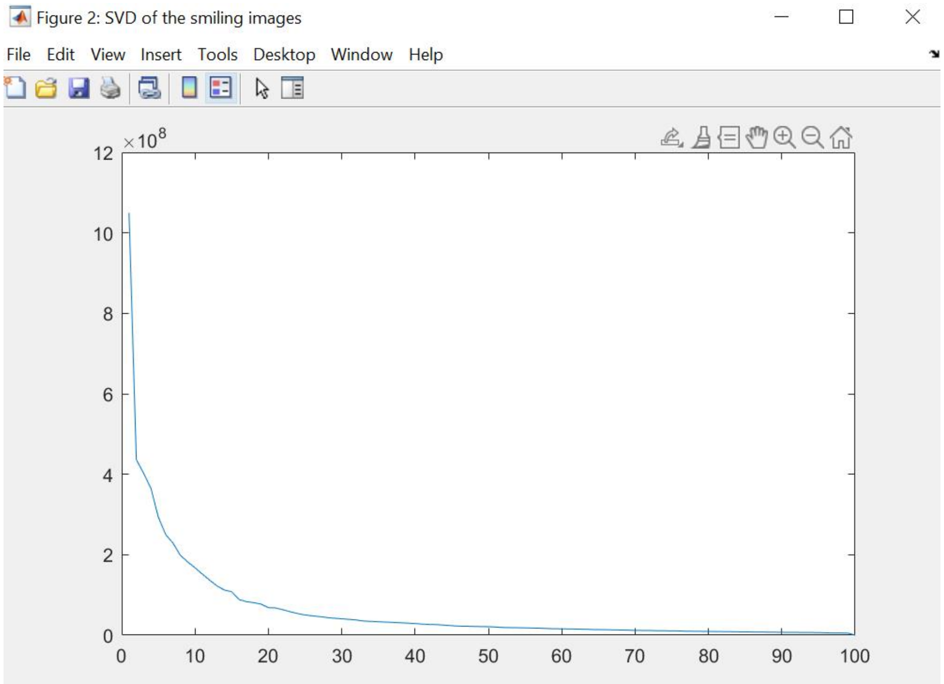
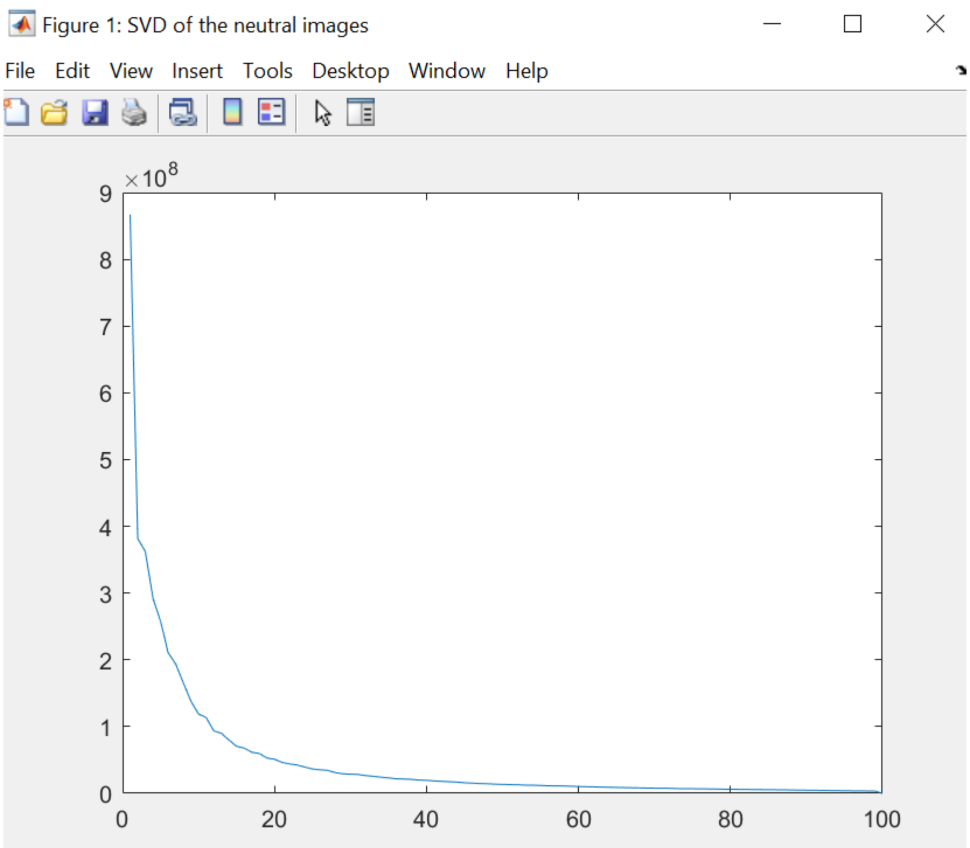
Part 1 : -

Plot of singular values for smiling images -



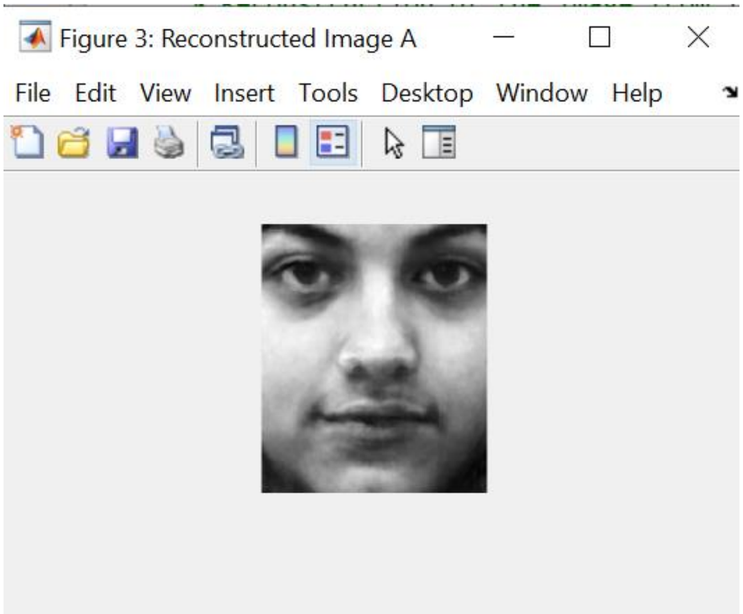
Plot for singular Values for neutral images : -



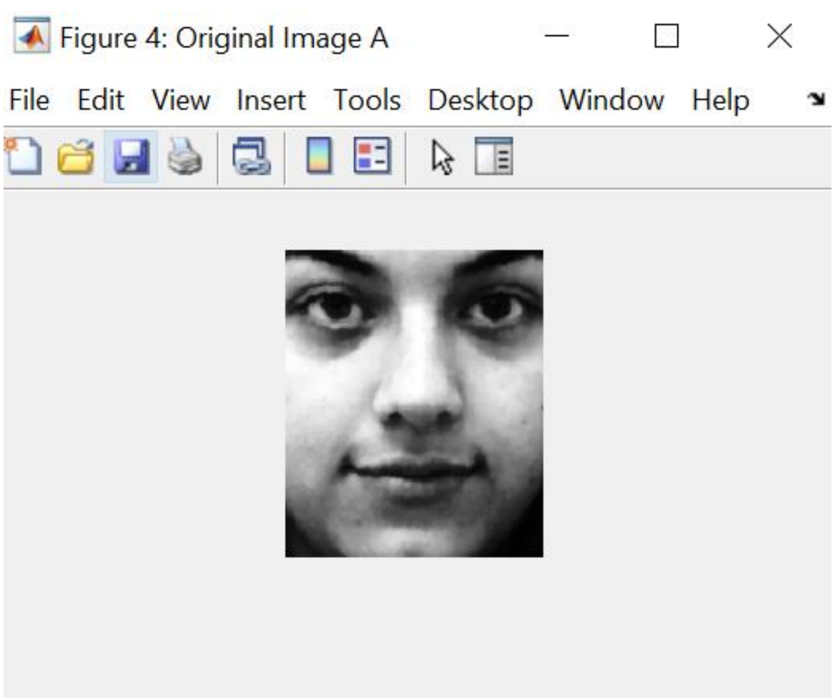
Part 1 comments – we see that if we take around (or more than) 60 principle components, it would contain major information about the images and could be used to reconstruct images successfully.

Part 2 :-

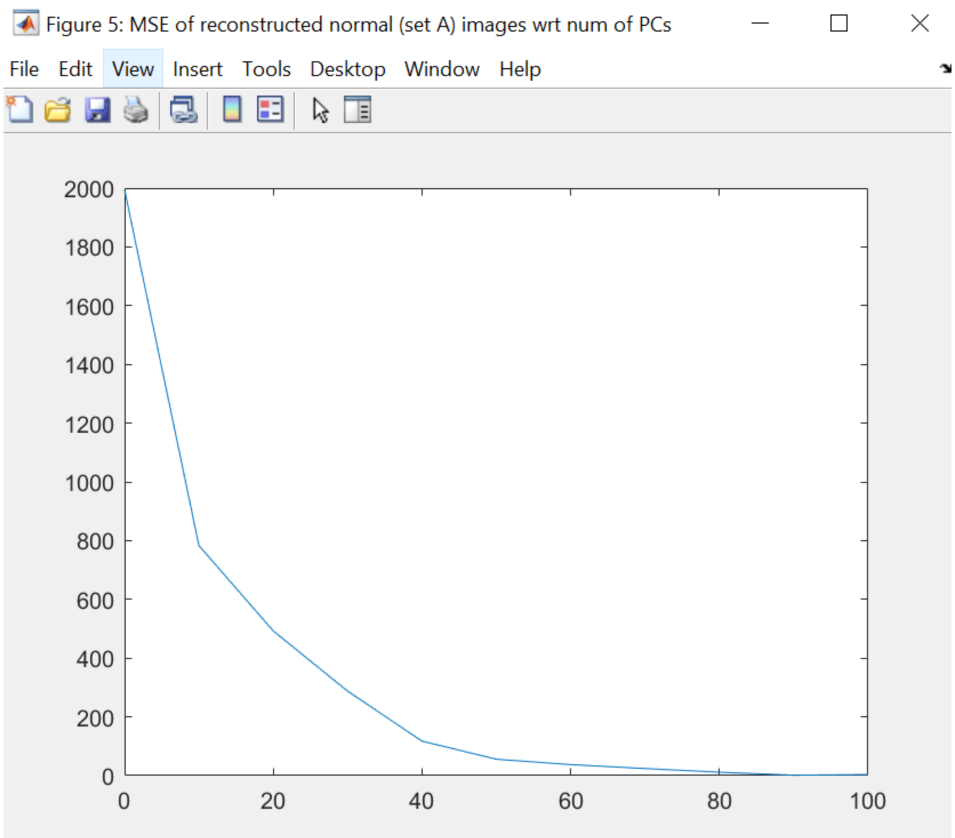
Reconstructed Image (Normal Face) with num of principle components k = 60



Original Image (Normal Face) for comparison with reconstructed Image



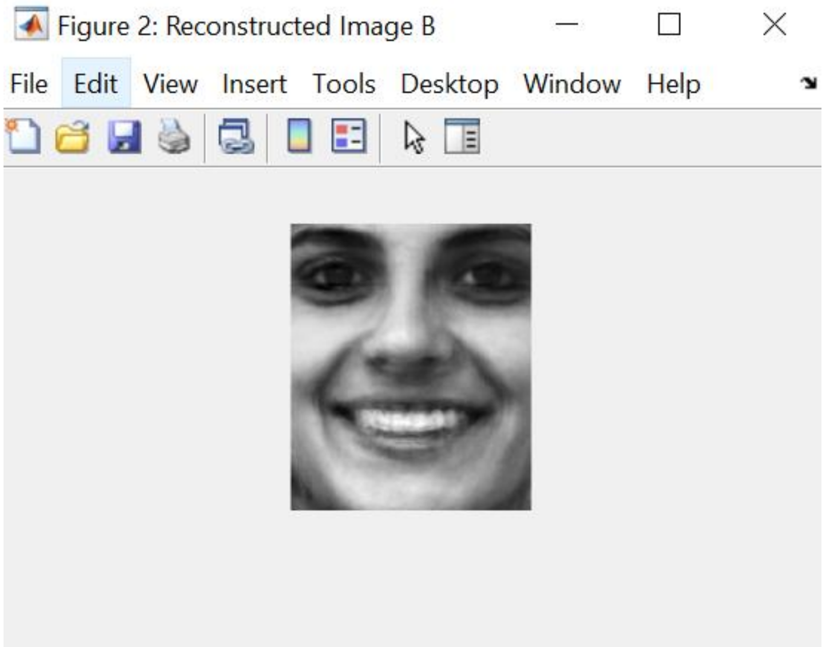
Plot of MSE vs Num of PCs for training set A -



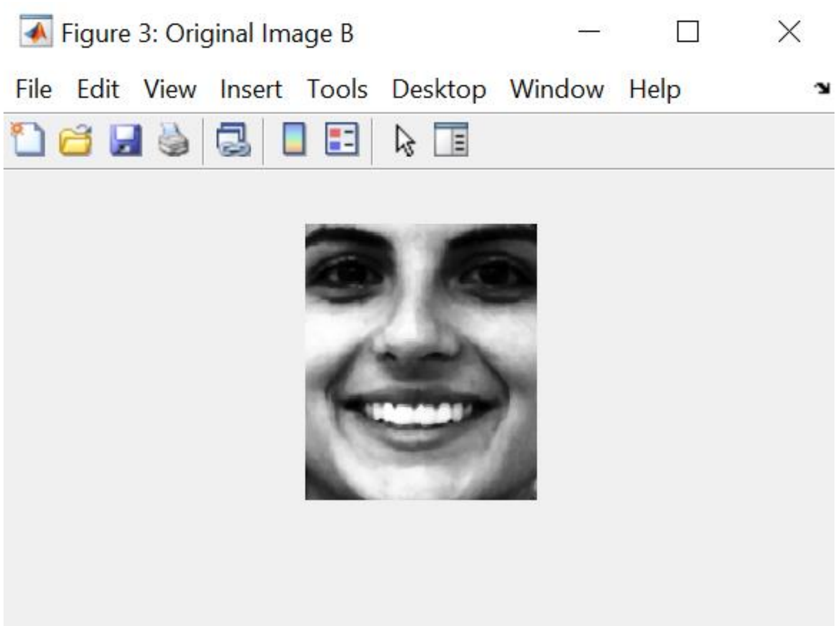
Part 2 Comments – we see that when we take about 60 principle components, the MSE is quite less and hence the reconstructed neutral images look quite similar to the original neutral images.

Part 3 -

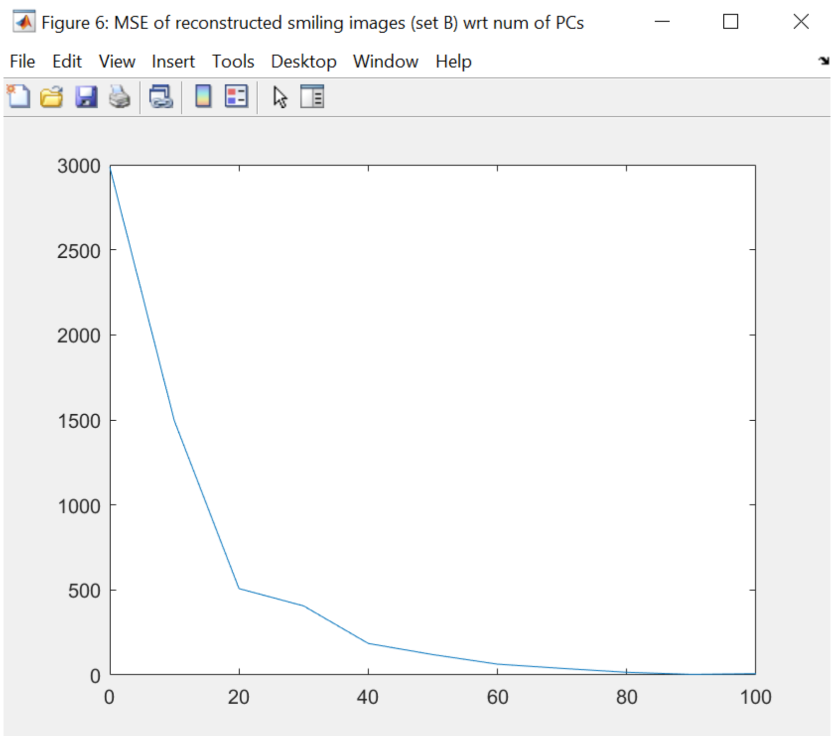
Reconstructed Image (Smiling Face) with num of principle components k = 60:-



Original Image (Smiling Face) for comparison –



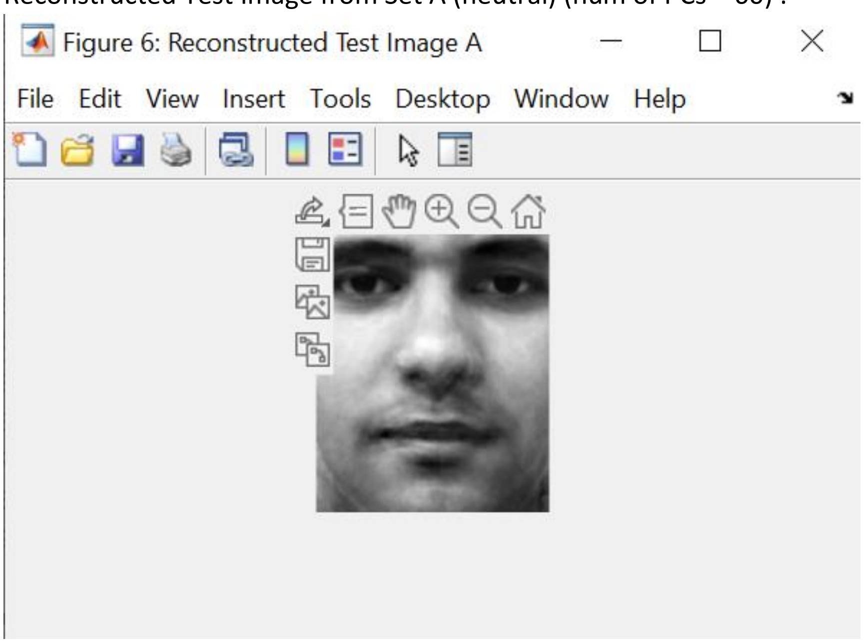
Plot of MSE vs number of PCs for training Set B (Smiling)



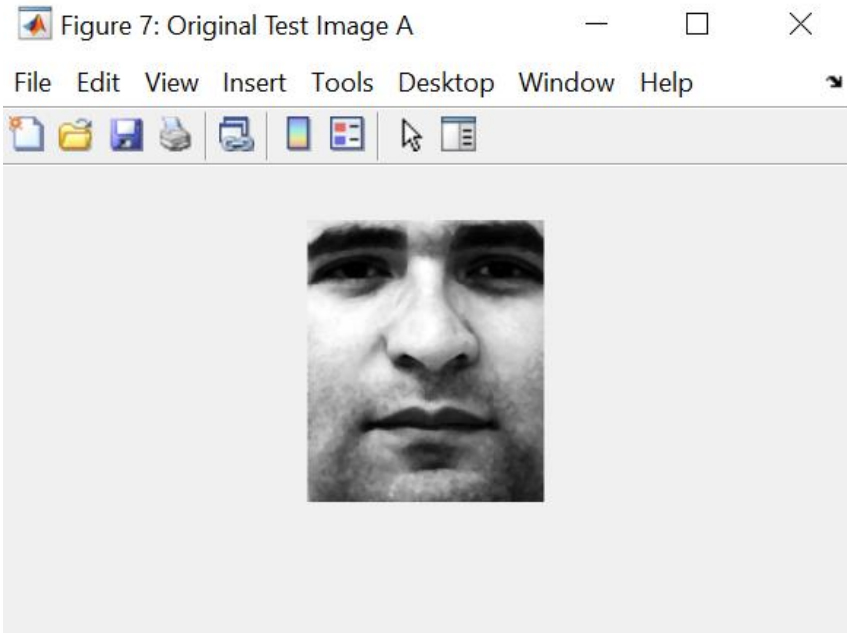
Part 3 Comments - we see that when we take about 60 principle components, the MSE is quite less and hence the reconstructed smiling images look quite similar to the original smiling images.

Part 4 -

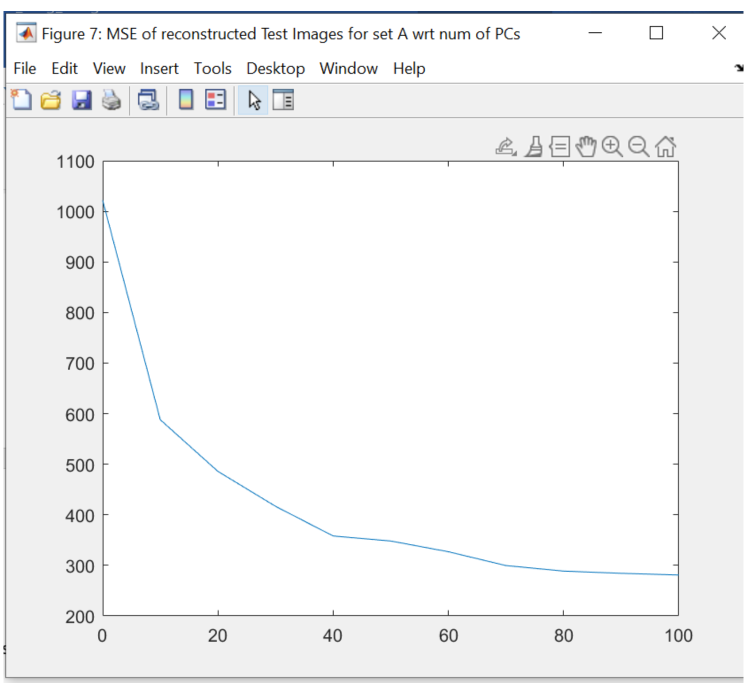
Reconstructed Test Image from Set A (neutral) (num of PCs = 60) :-



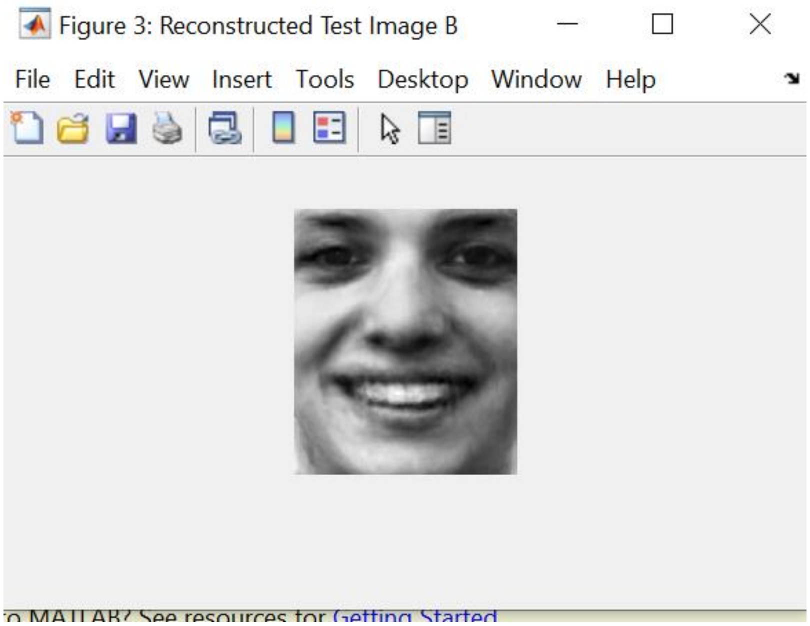
Original Test image (Set A (neutral)) for comparison :-



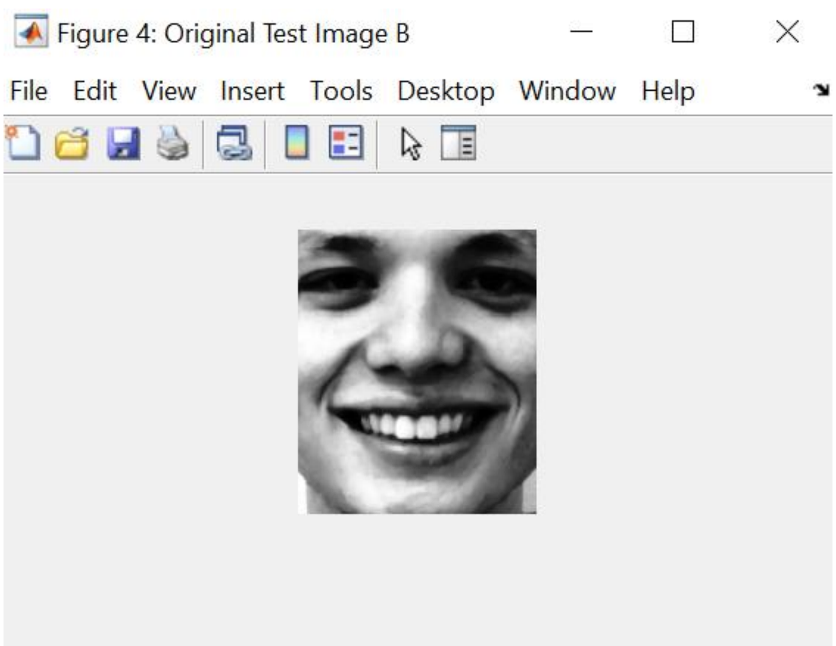
Plot MSE vs num of PCs for Test set A (neutral) :-



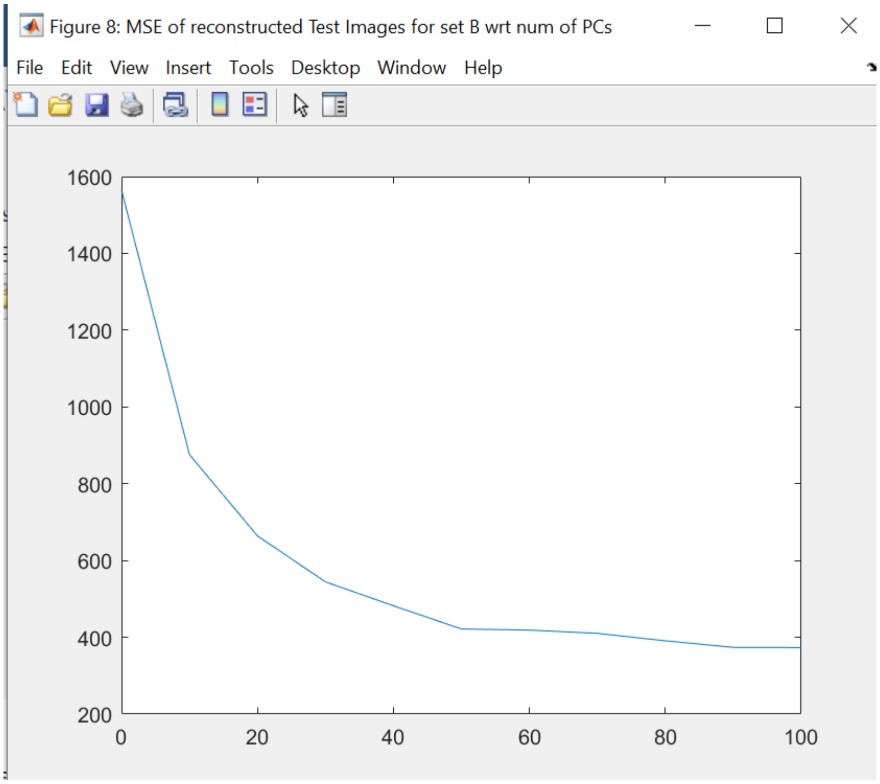
Reconstructed Test Image from Set B(Smiling) (Num of PCs used = 60) :-



Original Test Image Set B for comparison –



Plot of MSE vs num of PCs for Test Set B (smiling images)



Part 4 comments – we observe that we are able to sufficiently minimize the MSE when taking 60 principle components, and we are able to reconstruct both – neutral and smiling images preoperly.