**8.1**

1.1

1.

Layer 1: Convolutional layer 1

Input shape: [16, 3, 32, 32]

Batch\_size is 16, input has 3 channels (RGB), and input image size is 32x32.

Output shape: [16, 6, 28, 28]

Batch\_size remains 16, output has 6 channels, and output size is (32+1-5) x (32+1-5) = 28x28 due to 5x5 convolution.

Layer 2: Max pooling 1

Input shape: [16, 6, 28, 28]

Same as the output shape of the previous layer.

Output shape: [16, 6, 14, 14]

Batch\_size and channels remain the same, but spatial dimensions are halved due to 2x2 max pooling.

Layer 3: Convolutional layer 2

Input shape: [16, 6, 14, 14]

Same as the output shape of the previous layer.

Output shape: [16, 16, 10, 10]

Batch\_size is 16, output has 16 channels, and output size is (14+1-5) x (14+1-5) = 10x10 due to 5x5 convolution.

Layer 4: Max pooling 2

Input shape: [16, 16, 10, 10]

Same as the output shape of the previous layer.

Output shape: [16, 16, 5, 5]

Batch\_size and channels remain the same, but spatial dimensions are halved due to 2x2 max pooling.

Layer 5: Fully connected layer 1

Input shape: [16, 400]

After flattening, the input becomes [16, 1655] = [16, 400].

Output shape: [16, 120]

Batch\_size is 16, and output has 120 features as specified in the code.

Layer 6: Fully connected layer 2

Input shape: [16, 120]

Same as the output shape of the previous layer.

Output shape: [16, 84]

Batch\_size is 16, and output has 84 features as specified in the code.

Layer 7: Fully connected layer 3 (output layer)

Input shape: [16, 84]

Same as the output shape of the previous layer.

Output shape: [16, 10]

Batch\_size is 16, and output has 10 features corresponding to the 10 classes.

2.

Layer 1: Convolutional layer 1

Weights: 5 x 5 x 3 x 6 = 450

Biases: 6

Total: 450 + 6 = 456 trainable parameters.

Layer 2: Max pooling 1

No trainable parameters in max pooling layers.

Layer 3: Convolutional layer 2

Weights: 5 x 5 x 6 x 16 = 2400

Biases: 16

Total: 2400 + 16 = 2416 trainable parameters.

Layer 4: Max pooling 2

No trainable parameters in max pooling layers.

Layer 5: Fully connected layer 1

Weights: 400 x 120 = 48000

Biases: 120

Total: 48000 + 120 = 48120 trainable parameters.

Layer 6: Fully connected layer 2

Weights: 120 x 84 = 10080

Biases: 84

Total: 10080 + 84 = 10164 trainable parameters.

Layer 7: Fully connected layer 3 (output layer)

Weights: 84 x 10 = 840

Biases: 10

Total: 840 + 10 = 850 trainable parameters.

1.2

**8.2**

21.

2.2

2.3