Question 2

① Given that:

$$V_j = \sum_j^i W_j y_i$$

$$e_j = d_j - y_j$$

$$\text{error}, E = \frac{1}{2} \sum_j e_j^2$$

output from m layer neuron, $y_m = \phi(V_m)$

Here,

$$\delta_m = \frac{\delta E}{\delta V_m} = -\frac{\partial E}{\delta y_m} \frac{\partial y_m}{\delta V_m}$$

$$= -\frac{\delta E}{\delta y_p} \phi'(V_m)$$

And,

$$E(n) = \frac{1}{2} \sum_{p \in C} e_p^2(n)$$

$$\Rightarrow -\frac{\delta E}{\delta y_m} = \sum_{p \in C} e_p \frac{\delta e_p}{\delta y_m}$$

$$= -\sum_{p \in C} e_p (-1) \phi(V_p) W_{pm}$$

$$= \sum_{p \in C} \delta_p W_{pm}$$

$$\frac{\partial e_p}{\partial y_m} = \frac{\partial e_p}{\partial y_p}\frac{\partial y_p}{\partial v_p}\frac{\partial v_p}{\partial y_m}$$

$$= (-1)\,\phi'(v_p)\,w_{pm}$$

$$\therefore\ \delta_m = \phi'(v_m)\sum_{p\in c}\delta_p w_{pm}$$

Finally,

$$\delta_m = \begin{cases} e_p\,\phi'(v_m) & \text{[When. m is output neuron]} \\ \phi'(v_m)\sum_{p\in c}\delta_p w_{pm} & \text{[When m is hidden neuron]} \end{cases}$$

So, this is our computed local induced gradient, δ_m

(Ans)