$$= npe^t \left[(1-p)+pe^t\right]^{n-1} + n(n-1)(pe^t)^2 \left[(1-p)+pe^t\right]^{n-2}$$

$$\frac{d^2}{dt^2} Mgf_Y(t)\Big|_{t=0} = np \cdot 1 \cdot [1]^{n-1} + n(n-1)p^2 \left[\underbrace{(1-p)+p}_{=1}\right]^{n-2}$$

$$= np + n(n-1)p^2$$

$$= np + n^2p^2 - np^2 \qquad \text{— (II)}$$

$E(Y^2) = np + n^2p^2 - np^2$ from II

$E(Y) = np$ from I

$$var(Y) = E(Y^2) - E^2(Y)$$

$$\cancel{Var(X) = E(X^2) - E^2(X)}$$

$$= np + n^2\cancel{p^2} - np^2 - n^2\cancel{p^2}$$

$$= np - np^2$$

$$= np[1-p]$$

(Ans)

So, $Y \sim Bin(n,p)$ has $E(Y) = np$

$var(Y) = np(1-p)$.