Swanith Upadhye

Deadline : → 14th April 2s -

Ques 1 Appendix

$$\therefore \Gamma^{\alpha}_{\mu\nu} = \frac{\partial x^{\alpha}}{\partial x'^{\lambda}} \frac{\partial^2 x'^{\lambda}}{\partial x^{\nu} \partial x^{\mu}}$$

Coordinate transformation

$$\tilde{\Gamma}^{\tilde{\alpha}}_{\tilde{\mu}\tilde{\nu}} = \frac{\partial \tilde{x}^{\tilde{\alpha}}}{\partial x'^{\lambda}} \frac{\partial^2_{\tilde{\nu}} x'^{\lambda}}{\partial \tilde{x}^{\tilde{\nu}} \partial \tilde{x}^{\tilde{\mu}}}$$

$$= \frac{\partial x^{\alpha}}{\partial x'^{\lambda}} \frac{\partial \tilde{x}^{\tilde{\nu}}}{\partial x^{\alpha}} \frac{\partial x^{\nu}}{\partial \tilde{x}^{\tilde{\nu}}} \frac{\partial}{\partial x^{\nu}} \left(\frac{\partial x'^{\lambda}}{\partial x^{\mu}} \frac{\partial x^{\mu}}{\partial \tilde{x}^{\tilde{\nu}}} \right)$$

$$= \frac{\partial x^{\lambda}}{\partial x'^{\lambda}} \frac{\partial \tilde{x}^{\tilde{\alpha}}}{\partial x^{\lambda}} \frac{\partial x^{\nu}}{\partial \tilde{x}^{\tilde{\nu}}} \left(\frac{\partial^2 x'^{\lambda}}{\partial x^{\mu} \partial x^{\nu}} \frac{\partial x^{\mu}}{\partial \tilde{x}^{\tilde{\mu}}} \right.$$

$$\left. + \frac{\partial x'^{\lambda}}{\partial x^{\mu}} \frac{\partial x^{\mu}}{\partial x^{\nu} \partial \tilde{x}^{\tilde{\mu}}} \right)$$

$$= \frac{\partial \tilde{x}^\alpha}{\partial x^\alpha} \frac{\partial x^\nu}{\partial \tilde{x}^\nu} \frac{\partial x^\mu}{\partial \tilde{x}^\mu} \Gamma^\alpha_{\mu\nu}$$

$$+ \delta^\alpha_\mu \frac{\partial \tilde{x}^\alpha}{\partial x^\alpha} \frac{\partial x^\nu}{\partial \tilde{x}^\nu} \frac{\partial^2 x^\mu}{\partial x^\nu \partial \tilde{x}^\mu}$$

Second term

$$\frac{\partial \tilde{x}^\alpha}{\partial x^\mu} \frac{\partial^2 x^\mu}{\partial \tilde{x}^\nu \partial \tilde{x}^\mu}$$

$$\therefore \quad \tilde{\Gamma}^{\tilde{\alpha}}_{\tilde{\mu}\tilde{\nu}} = \frac{\partial \tilde{x}^\alpha}{\partial x^\alpha} \frac{\partial x^\nu}{\partial \tilde{x}^\nu} \frac{\partial x^\mu}{\partial \tilde{x}^\mu} \Gamma^\alpha_{\mu\nu}$$

$$+ \quad \frac{\partial \tilde{x}^\alpha}{\partial x^\mu} \frac{\partial^2 x^\mu}{\partial \tilde{x}^\nu \partial \tilde{x}^\mu}$$

$\longrightarrow$ Not a tensor transformation.