

**ADVANCED DYNAMICS — PHY 4241/5227**  
**SOLUTIONS – SET 12**

Problem 39: Invariance under Gauge Transformations.

$$F^{\alpha\beta} = \partial^\alpha A^\beta - \partial^\beta A^\alpha, \quad A'^\alpha = A^\alpha + \partial^\alpha \Lambda.$$

Then,

$$F'^{\alpha\beta} = \partial^\alpha A'^\beta - \partial^\beta A'^\alpha = \partial^\alpha A^\beta + \partial^\alpha \partial^\beta \Lambda - \partial^\beta A^\alpha - \partial^\beta \partial^\alpha \Lambda = \partial^\alpha A^\beta - \partial^\beta A^\alpha = F^{\alpha\beta}.$$