

Statistical field theory

(BMEETE15MF39)

Examination topics

1. Second order phase transitions. Critical exponents, scaling laws, universality. Field theoretic description of the Ising model in d dimensions.
2. Renormalisation group. Blocking, RG flow of couplings, fixed points. Linearisation near fixed points, classification of couplings. Example of 1d Ising spin chain.
3. Landau-Ginsburg description. Wilson's RG in field theory, beta function and its relation to fixed points and critical exponents. Idea of ϵ expansion.
4. Conformal field theory in d dimensions. Conformal symmetry, energy-momentum tensor, scaling fields. Conformal Ward identities. 2 and 3 point functions.
5. Conformal symmetry in 2 dimensions. Primary and quasi-primary fields, Ward identity. Energy-momentum tensor, Ward identity and its relation to the free energy.
6. Virasoro algebra. Operator-state correspondence. Correlators of descendent fields from Ward identities.
7. Highest weight representations. Verma modules. Singular vectors. Minimal models. Operator product expansion in minimal models.
8. Modular invariance and partition functions. Operator product coefficients and conformal bootstrap.
9. Vicinity of critical point. C-theorem. Perturbative RG flows. Example: flows induced by $\Phi_{1,3}$ perturbation of a minimal model.