School of Mathematics

Course 432 — Classical Fields (JS Theoretical Physics, JS & SS Mathematics)

Lecturer: N. H. Buttimore

Requirements/prerequisites: 221, 231, 241

Duration: 19 weeks.

Number of lectures per week: 3

Assessment: Tutorial exercise (results used to assess borderline cases).

End-of-year Examination: One 3-hour examination (upon which final grade is based).

Description: See http://www.maths.tcd.ie/~nhb/432.php for more detailed information.

Lagrangian density for a field, Hamilton's variational principle, scalar and vector fields, covariant field theory. Lorentz force for charged particles, four-vector potential, Maxwell equations for the antisymmetric tensor describing electric and magnetic induction fields. Lorenz gauge, conserved charges and currents, symmetric gauge invariant stress tensor, particle and field energy-momentum, angular momentum conservation,

Green functions for Laplacian and d'Alembertian operators, Liénard-Wiechert potentials, velocity and acceleration fields for a moving charge, radiation. Larmor's formula, relativistic angular distributions, radiation damping, decay of radius for a circular orbit. Classical electrodynamics and its relation to quantum electrodynamics, quantum chromodynamics and gravity.

December 9, 2008

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