THEORETICAL SEISMOLOGY

Part I Seismic sources

1. Faulting

Rupture process. Faults and their geometry. Strike, dip, rake and slip
Brittle deformation and stresses. Tensile cracking. Shear fracture and Coulomb criterion
Frictional sliding. Byerlee's law
Stresses and faulting. Stress cycle & Stick slip

2. Faults and their representation

Elastodynamic basic theorems
Elastodynamic Green function
Representation theorem

3. Faults and body forces

Equivalent body forces
Moment density tensor
Shear Dislocation Far source condition. Moment tensor. Seismic moment.
Double couple. Faults and moment tensor components
Application to a specific case

4. The elastodynamic Green function

Impulse response & Transfer function. Transformed domain. Convolution theorem
Spherically symmetric problem. Lamè theorem
GF in a isotropic and homogeneous medium. Near and far field
Response to a double-couple. Near, intermediate and far field

5. Focal mechanisms

Faulting and radiation pattern
Basic fault plane solutions
Faults and plates

Part II Earthquakes and their measurement

6. Source spectrum

Extended faults. Haskell model.
Rupture time. Directivity
Source spectra. Omega square model

7. Principles of seismometry

Seismometry. Inertial instruments
Mechanical and electromagnetic instruments. Response curves
Digital signals; sampling & dynamic range
Broad band instruments; Feedback & Force balance
Strong motion. Seismic noise

8. Intensity and magnitude measurements

Intensity
Magnitude. M_L, m_b, M_S. Saturation
Similarity conditions: geometric and dynamic
Moment Magnitude

9. Viscoelasticity

Rheology. Viscoelasticity
Viscoelastic models: Maxwell, Kelvin-Voigt
Standard Linear Solid. Complex moduli

10. Seismic attenuation

Intrinsic Attenuation: Q of the Earth
Intrinsic Dispersion

Part III Hazard and Tsunami Physics

11. Seismic Hazard

Hazard and risk
Source and site effects
Seismic Hazard.

12. Tsunami physics and hazard

Long Gravity waves. Excitation by seismic sources
Tsunami modeling
Tsunami hazard