1. Transmission Electron Microscopy
   - Units and unit conversion: length, angle, solid angle
   - Small-angle approximation
   - Relativistic electron wavelength

2. Scattering and Diffraction
   - Terminology: elastic/inelastic, coherent/incoherent, forward/back scattering
   - Scattering cross-section (units), mean free path
   - Two-slit interference, diffraction from single slit, Rayleigh criterion
   - Convergence & collection angles

3. Elastic Scattering
   - Wave parameters: amplitude, phase, wavelength, frequency, velocity, wave number, wave vector
   - Complex exponential form of a wave, finding magnitude squared (intensity)
   - Atomic scattering amplitude (form factor), nature of the interaction of electrons with atomic matter
   - Weak-phase-object approximation, structure factor, Bragg law

4. Inelastic Scattering
   - Inelastic scattering processes: collective excitations, X-ray emission, secondary electrons, excitons,…
   - Effects of ionization: characteristic X-ray emission, Auger electron emission
   - Bremsstrahlung: braking radiation

5. Magnification and Electron Sources
   - Ideal lens equation
   - Lateral and angular magnification
   - Brightness definition, conservation of brightness
   - Thermionic and field-emission types

6. Electron Lenses
   - Depths of field and focus
   - Spherical aberration, effect on focal length, effect on image resolution
   - Factors affecting practical resolution
   - Principles of a magnetic electron lens, axially symmetric B-field, Lorentz force
7. Instrument Operation
- Condenser system, lateral demagnification
- Influences of C1, C2, and C3 on probe size; influence of CA on convergence angle
- Deflection lenses: beam tilt and shift
- Lens planes, back focal plane vs. image plane
- Imaging modes: bright-field, off-axis dark-field, centered dark-field

8. Vacuum systems and TEM holders
- Vacuum terminology: LV, HV, UHV
- Pumps: Mechanical rotary; oil diffusion, turbomolecular, ion getter
- Gauges: Pirani (thermal), Penning (ion)
- Specimen loading, tilt axes

Significant Figures and Round-Off Criteria for Numerical Expressions
- Reasonable number of significant figures based on information available
- Rules for rounding off

Labs
1. TEM Magnification Calibration
2. TEM Diffraction Calibration
3. TEM Analysis of Nanoparticles
4. TEM Analysis of Carbon Nanotubes
5. Individual TEM
6. TEM Sample Prep - Polishing, Dimpling, Ion Milling