Preliminary Study Guide

1. Coulomb law and applications (Chapter 23), especially Section 23.3 (Examples 23.2-23.4)

1) three charged beads on a insulating rod and equilibrium (Problem 23.13)
2) equilibrium of the electric charge in electric and gravitational field (Problem 23.33)

2. Gauss law and its applications (Chapter 24; Problems 24.11, 24.17)

1) Derivation of the electric field from an infinite uniformly charged thin rod (Example 24.4)
2) Derivation of the electric field from an insulating uniformly charged spherical shell
3) Derivation of the electric field from an insulating uniformly charged solid sphere (Example 24.3)
4) Electric field of an infinite plane (Example 24.5)

3. Electric field (Chapter 23) and electric potential (Chapter 25; Example 25.3) of uniform charge distributions (Sections 23.5, 25.5)

1) infinite uniformly charged thin rod (at some distance away from the rod, example 23.7, Problem 25.45)
2) uniformly charged ring (Example 23.8, Example 25.5, Problem 25.47)
3) uniformly charged semicircular rod (the electric field at the center of the circle, Problems 23.45, 25.44)
4) electrostatic shielding (Section 24.4, Example 24.7): explanation based on electric field and electric potential of a charged conducting spherical shell
5) electric field and electric potential inside, on surface and outside conducting solid sphere (Section 25.6)

4. Capacitors and dielectrics (Chapter 26)

1) Definition of capacitance and capacitance of a spherical conductor (Sections 26.1, 26.2)
2) Capacitance of a parallel-plate capacitor (Section 26.2)
3) Capacitors in combination: derivation of equivalent capacitance for capacitors connected in parallel (Section 26.3)
4) Capacitors in combination: derivation of equivalent capacitance for capacitors connected in series (Section 26.3)
5) Capacitors in combination (Example 26.3, Problems 26.22, 26.25)
6) Energy stored in a charged capacitors: derivation (Section 26.4)

5. Electrical current and Ohm's law (Chapter 27):

1) Resistance of conducting wire and its relation to the length and the cross-sectional area (Section 27.2, Example 27.2)
2) Resistance in combination: resistance in series and in parallel (Section 28.2)
3) Equivalent resistance for resistance in combinations (Examples 28.4, 28.5, Problems 28.7, 28.9, 28.17, 28.21)

6. DC circuits (Chapter 28)

1) Kirchhoff's rules and their applications: single loop circuits and multi loop circuits (Sections 28.3, Examples 28.6, 28.7, Problems 28.31, 28.33a)
2) RC circuit -- charging a capacitor (Section 28.4, Example 28.9)

7. Magnetic field (Chapter 29-30-31-32)

1) Charged particle in magnetic field (Section 29.3, Problem 29.16)
2) Ampere's law and applications (magnetic field inside and outside long wire (Example 30.5, Problem 30.38), magnetic field inside long solenoid (Section 30.4))
3) Bio-Savart law and applications (derivation magnetic field at the center of a circular loop, Example 30.3)
4) Magnetic field of some combinations of wires (Example 30.2, Problems 30.7, 30.10, 30.13)
5) Magnetic flux and Faraday's law (Example 31.3, Problem 31.13, Problem 31.26)
6) Magnetic energy: derivation (Section 32.3)
7) Inductance of a long solenoid: derivation (Example 32.1)
8) RL circuits: qualitative understanding (as discussed during the corresponding group work, Section 32.2)

8. AC circuits (Chapter 33):

1) resistor circuits (derivation of the current as function of time), Section 33.2
2) capacitor circuits (derivation of the current as function of time), Section 33.4
3) inductor circuits(derivation of current and charge as function of time), Section 33.3
4) freely oscillating LC circuit (derivation of Q(t) and I(t)), Section 32.5

9. Maxwell equations (Chapter 34):

1) Qualitative discussion of Maxwell equation: physical meaning (Section 34.2, Eq. 34.4-34.7 must be remembered by heart!)
2) Qualitative discussion on EM waves (Section 34.3)
3) Wave equation and harmonic traveling wave solutions (Section 34.3)
4) Definition and physical meaning of Poynting vector (Section 34.4, 34.5, Example 34.5)