First Half of the Course

1. Understand the importance and relevance to cosmology of the following
   - The night sky is dark
   - the universe contains stuff
   - galaxies are moving away
   - The universe if filled with a background radiation
   - The universe is isotropic and homogeneous
2. What are the meanings of and the mathematical expressions for:
   - Redshift
   - Scale Factor
   - Hubble parameter and Hubble law
3. From general relativity, give the meaning of, and where appropriate, the mathematical expression for:
   - Euclidean space
   - Curvature
   - Metric
   - Robertson-Walker metric and when its the appropriate metric to use
   - Null geodesic
   - Proper distance
   - The relationship between Redshift and scale factor.

4. The Friedmann equation
   - Write the general Friedmann equation in all its different forms and discuss the advantage of each form
   - What is the fluid equation and how does the w parameter come into play.
   - What is the acceleration equation.
   - Write the Friedmann equation in terms of the density parameters. What is the meaning of the critical density and what is it's mathematical expression. How is Ω_o related to the curvature of the universe.
   - Write down the Friedmann equation for single component uni- verses and discuss some of the behavior for each component.
   - Write down the Friedmann equation for examples of multi-component toy universes and discuss the physical consequences of these universes. Compare the toy universes to the one we seem to live in.

From second half of the course

1. The search for two numbers, H_o and q_o
   - Proper distance
   - Luminosity distance
   - Angular diameter distance
2. Cosmic Microwave Background
   - Observational characteristics of CMB
   - Recombination and Decoupling
   - Photon scattering and number density of photons and baryons
   - The physics of recombination
   - The temperature fluctuations and their causes

3. Dark Matter
    - Observational evidence for dark matter in galaxies—rotation curves
    - Observational evidence for dark matter in clusters of galaxies—the virial theorem
    - Observational evidence for dark matter via gravitational lensing
4. Inflation
    - The problems with the Friedmann model that lead to the postulating of inflation
    - The general idea behind how inflation solves the problems
    - The physics of inflation
5. Structure formation
    - Definition of density perturbations
    - Growth of over-densities in a static universe—The Jeans length
    - Growth of over-densities in an expanding universe
    - The Power Spectrum
    - Hot versus Cold matter
    - Baryon Acoustic Oscillations