I - MATHEMATICS AND PHYSICS

Mean, variance, moments of a distribution
Binomial distribution, Poisson distribution, and Gaussian distribution
Least-squares method
Taylor series
Fourier series and transform
Fundamental laws of Nature
Physical quantities and units
Kinetic energy, potential energy, thermal energy
Angular momentum, orbital angular momentum, spin angular momentum
Laws of thermodynamics
Phase space
Virial theorem
Gravitational field, electromagnetic field
Maxwell's equations
Thomson and Compton scattering, syncrothron radiation, free-free absorption
Blackbody radiation, Planck function
Radiation pressure
Reflection, refraction, inteference, diffraction, aberrations
Conduction, covection, radiation, diffusion
Heisenberg's principle
Bohr model of the atom
Laser emission, maser emission
Space and time in Galilean, Special and General Relativity
Time dilation and Lorentz contraction in Special Relativity
Classical and relativistic Doppler shift
Aberration of the light
Equivalence principle

II - ASTRONOMY

Magnitudes and colors
Photometric systems
Surface brightness
Isophotes, isophotal radii
Parallax
Distance modulus
Cosmic distance scale
Redshift
Jeans criterion
Eddington limit
Fundamental and Local Standard of Rest
Solar motion, Solar apex
Stellar proper motions and radial velocities
Velocity ellipsoid
Differential rotation of the Milky Way, Oort costants
Core and tidal radius of a stellar cluster
Classification and physical interpretation of stellar spectra
Stellar opacity, formation of spectral lines and continuum
Emission and absorption spectral lines
Molecular spectral lines
21-cm spectral line
Pressure, temperature, and gravity in stellar atmospheres
Extinction, reddening
Gravitational lensing
X-ray, ultraviolet, optical, infrared, and radio telescopes

III - THE SOLAR SYSTEM AND EXTRASOLAR PLANETS

Albedo

Kepler's laws
Two-body problem
Physical properties of the Sun and Solar System
Roche model, Lagragian points
Oort cloud, Kuiper belt
Escape velocity in planet atmospheres
Detection of extrasolar planets

IV - STARS AND INTERSTELLAR MEDIUM

Perfect gas, degenerate gas
Stefan's law, Wien's law
Botzmann's law, Saha's law
Color temperature
Thermonuclear reactions: proton-proton chain, CNO cycle, triple alpha reaction
Initial mass function
Stellar populations
Globular clusters, open clusters
Stability of the stars: radiative and convective transfer
Stellar evolution, isocrones
Hayashi line
Properties of the color-magnitude diagram
Properties of the stars on the main sequence
RR Lyrae, cepheids, planetary nebulae, supernovae
Chandrasekar mass, white dwarfs
Oppenheimer-Volkoff mass, neutron stars, black holes
Properties of the interstellar medium

V - GALAXIES AND INTERGALACTIC MEDIUM

Properties of the galaxies
Hubble sequence, de Vaucouleurs' classification, luminosity class of galaxies
Active galactic nuclei: radio galaxies, Seyfert galaxies, blazars, quasars
Dark matter in galaxies
The Local Group
Surface brightness profile of galaxies
Rotation curve, velocity dispersion profile
Galaxy mass
Galaxy luminosity function
Galaxy color-magnitude diagram
Faber-Jackson law, Fundamendal Plane, Tully-Fisher law
Black hole mass-velocity dispersion relation
Chemical evolution of galaxies

VI - GALAXY CLUSTERS AND COSMOLOGY

Properties and classification of galaxy clusters
Galaxies, dark matter, and gas in galaxy clusters
Free-fall time
Galaxy cluster mass
Matter and energy in the Universe
Hubble's law
Cosmic microwave background
Cosmological principle, Robertson-Walker metric
Standard Friedmann's models of the Universe
Universe models with non-zero cosmological constant
Cosmological parameters
Cosmological horizon, event horizon
Thermal history of the Universe
Nucleosynthesis in the early Universe
Inflation
Correlation functions, spectrum of initial fluctuations

Fluctuations in the cosmic microwave background radiation
Sunyaev-Zeldovich effect