Dynamic Meteorology MAPH P310

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Syllabus

Text: *An Introduction to Dynamic Meteorology*,
Fourth Edn., **J. R. Holton**, Elsevier Press, 2004.

1 Dynamic Meteorology

1.1 *Basic Fluid Dynamics (8 Sessions).*

Local and Material Time Derivatives. Conservation Principles. Euler and Navier Stokes Equations. Hydrostatic Approximation. Advection. Vorticity. Divergence. Scale Analysis.

1.2 *The Equations in Rotating Coordinates (4 Sessions).*

Spherical Coordinates. Dynamical Effects of Rotation. Equations of Motion. Continuity Equation. Equation of State. First Law of Thermodynamics. The Complete System of Equations.

1.3 *Elementary Solutions (4 Sessions).*

Geostrophic Balance. Balanceed Curved Flow; Gradient Wind. Cyclostrophic and Inertial Flow. Vertical Shear: The Thermal Wind.

1.4 *Shallow Water Equations (8 Sessions).*

Linear Wave Motion. Rotational and Gravity Waves. Hough Functions. Equatorial Waves.

1.5 *Atmospheric Wave Motion (8 Sessions).*

Free Rossby Waves. Forced Rossby Waves: Orographic and Thermal. Acoustic Waves. Lamb Mode. Kelvin Waves. Potential Vorticity Conservation: Theory and Applications. Group Velocity.

1.6 *Quasi-geostrophic Equations (12 Sessions).*

Derivation of the system. The Omega Equation. Filtering of Gravity Waves. Geostrophic Adjustment.

1.7 *Hydrodynamic Instability Theory (10 Sessions).*

Barotropic Instability. The Two-level Model. Baroclinic Instability: Eady Model.

1.8 *Atmospheric Energetics (6 Sessions).*

Kinetic and Potential Energy. Available Potential Energy. Sources and Sinks of Energy. Atmospheric Energy Balance.