Lecture Week 13: Final check points:

Here are some words and concepts that we have covered in the course.

scales of motion	synoptic	continuity equation	conservation of heat
equation of motion	1st law of therm	adiabatic	virtual temperature
diabatic	advection	real forces	apparent forces
Coriolis	Lagrangian	Eulerian	partial derivative
pressure gradient	hydrostatic law	hypsometric equation	potential temperature
heat capacity	DALR	entropy	natural coordinates
geostrophic	gradient wind	cyclostrophic wind	geotriptic wind
thermal wind	tephigram	hodograph	instability
LCL	CCL	LFC	convective temperature
vectors	mid-latitude cyclone	ideal gas law	jet streams
jet streak (max)	SALR	wet bulb potential temperature	Poisson's Eq.
stability	Normand's Rule	RADAR	dBZ
Doppler radar	PPI	RHI	CAPPI
tephigram	R_d	C_p	C_v
jet / divergence	vorticity	relative vorticity	planetary vorticity
shear	curvature	solenoids	vorticity equation
laplacian	lee trough	frontal structure	frontal kinematics
translation	rotation	conv/div	deformation
frontogenesis	frontolysis	confluence	shear
NWP	finite differencing	resolution	satellite imagery
omega equation	pressure tendency	thickness advection	self development
isallobar	potential vorticity	barotropic instability	baroclinic instability
trough	ridge	airmass	Rossby wave
EAPE	ZAPE	EKE	ZKE
blizzard	windchill	Arctic outflow	ice storm
thunderstorm / lightning	tornado	derecho	hurricane

Final exam format and example questions:

The exam is out of 50 marks and is designed to fit in 3 hours. It is closed book. Bring calculator, pencil, coloured pencils/pens, and ruler. You will answer on the exam sheets. There will be five multi-part questions:

1. Five "define and explain in the context of this course" (e.g., words from above list). (10 marks)
2. Two short-answer questions that may include a figure (10 marks)
3. One calculation question chosen from a list (e.g., look at previous examples, labs, and problems given in class) (10 marks)
4. One essay question chosen from a list (e.g., discuss how frontogenesis occurs, how a cyclone intensifies) (10 marks) The essays will be limited to one page each.
5. One lab question that may include a figure (e.g., plot and explain a tephigram or analyze satellite/radar imagery) (10 marks)

Some equations you may (or may not) find useful:

$$
\begin{aligned}
-\frac{\partial \rho u}{\partial x} - \frac{\partial \rho v}{\partial y} - \frac{\partial \rho w}{\partial z} &= \frac{\partial \rho}{\partial t} \\
dQ &= dW + dI \\
P &= \rho R_d T, R_d = 287 \text{ J kg}^{-1} \text{ K}^{-1} \\
T_v &= (1 + .61q)T \\
\theta &= T_v(\frac{1000}{P})^{\frac{R_d}{C_p}}, C_p = 1010 \text{ J kg}^{-1} \text{ K}^{-1} \\
\frac{\partial \theta}{\partial t} &= -u\frac{\partial \theta}{\partial x} - v\frac{\partial \theta}{\partial y} - w\frac{\partial \theta}{\partial z} + S_\theta \\
\frac{dP}{dz} &= -\rho g \\
\Delta z &= \frac{\Delta p}{p}\frac{R_d T}{g}, g = 9.8 \text{ m s}^{-2} \\
\Delta z &= \ln(\frac{p_1}{p_2})\frac{R_d T}{g} \\
\frac{\partial \vec{V}}{\partial t} &= -\vec{V} \cdot \nabla \vec{V} - \frac{1}{\rho}\nabla p - 2\Omega \times \vec{V} - g\hat{k} + F_r \\
f &= 2\Omega \sin\phi = 2 \times 7.27 \times 10^{-5} \sin\phi \\
V_g &= -\frac{1}{\rho f}\frac{dP}{dn} = -\frac{g}{f}\frac{dZ_p}{dn} \\
\text{cyclonic: } fV + \frac{V^2}{R} &= -\frac{1}{\rho}\frac{dP}{dn} \\
\text{anticyclonic: } fV - \frac{V^2}{R} &= -\frac{1}{\rho}\frac{dP}{dn} \\
\frac{V^2}{R} &= -\frac{1}{\rho}\frac{dP}{dn} \\
V_T &= V_{g2} - V_{g1} = \frac{g}{f}(\frac{d\Delta Z_p}{dn}) = \frac{R_d}{f}\frac{\Delta P}{P}\frac{dT}{dn} \\
P &= P_0 \exp^{(-Z/H)} \\
H &= R\overline{T}/g \\
\zeta &= \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} \\
\zeta &= -\frac{\partial V}{\partial n} + \frac{V}{R} \\
\zeta_g &= \frac{g}{f}\nabla_p^2 Z + u_g\frac{\beta}{f} \\
\zeta_g &\approx \frac{4}{d^2}\frac{g}{f_0}(\bar{Z} - Z_0) \\
\eta &= \zeta + f \\
\eta_p &= \frac{(\zeta + f)}{\Delta z} \\
\beta &= \frac{df}{dy}
\end{aligned}
$$