

# ME 370 Review

## Issues of Importance

### Exp. 1 Drag Coefficient

definition of drag coefficient

measurement of the drag coefficient:

- describe the technique and errors associated with the pressure distribution method

function of a pitot static tube:

- definition and difference between static pressure, free stream velocity pressure, and stagnation pressure

determining speed in the wind tunnel from static pressure drop:

- derivation of mass flow expression from Bernoulli's eq. and continuity
- calculation of density from pressure and temperature
- difference between absolute and gauge pressures

how the drag on an object is related to the pressure differential and the flow separation point

experimental method to identify the location of the separation point

effective length of objects within the wind tunnel

### Exp 3 Flow measurement

definition of discharge coefficient - how it relates real measurements to ideal calculations of flow.

expected discharge coefficients for calibrated flow meters, venturi, orifice, and nozzle.

definitions of pressure loss and pressure differential for constant area - variable head flow meters.

difference between gauge and absolute pressure, calculation of air density from ambient conditions.

the effect of inlet / exit pressures on mass flow rate through nozzle.

how each of 7 flow devices work

### Exp 6 C-D Nozzle

relationship between enthalpy change and velocity change

definition of stagnation conditions

pressure conditions at inlet / outlet which cause subsonic, critical, supersonic flows, normal shock waves - associated pressure distributions

changes in pressure and velocity across a shock front

why shape of nozzle results in continually increasing velocity

how to read and use isentropic flow table

how to read and use normal shock table

definition of critical pressure and design pressure at nozzle exit

effect of inlet / exit pressure on mass flow rate for choked flow

comparison of real pressure distribution to 1-D isentropic flow pressure distribution

### Exp 8 Heat Pump, Refrigerator

definition of performance parameters: COP, HP/ton, capacity, EER

function and purpose of expansion valve

use of P- h diagram

effect of evaporator temperature on: cooling capacity, compressor work, COP, EER

means of calculating capacity and COP based on transient temperatures in cold and warm reservoirs, and based on energy balance for refrigerant

refrigeration cycle: demonstration of 1st law of thermodynamics, operation of each component in cycle, definition of superheated and subcooled states.

calculation of UA and effectiveness for the various heat exchangers.

### Exp 11 Centrifugal Fan

Definition of center coefficient, why is it useful

definition of fan laws - how they are useful

difference between fan and system characteristics - definition of system resistance

energy conversion from brake horse power to four types of energy: thermal (losses), kinetic (velocity), static pressure rise, internal energy (temperature rise)

derivation of flow rate from pitot tube measurement  
fan laws : calculation of drop in HP if change in flow  
different methods of regulating flow - which is more advantageous?  
definition of system resistance

### Exp 13 Air Compressor

advantage of 2 stage vs. single stage compression for given pressure ratio  
benefit of intercooling  
volumetric efficiency as function of receiver pressure, mass flow rate, speed  
definition of polytropic process, how to determine the polytropic exponent "n", and meaning of exponent.  
why is brake HP greater than isentropic HP even when  $1 < n < 1.4$  ?  
determination of mep (mean effective pressure)  
system energy balance - where does the energy go?

### Exp 15 Steam Turbine

method of measuring inlet enthalpy  
determining quality of liquid from position under the vapor dome  
dependence of torque and hp on speed  
effect of inlet pressure at constant speed on torque and power  
changing number of nozzles - impact on pressure, efficiency, and flow for constant hp  
thermal efficiency as function of speed  
difference between impulse and reaction turbine

### Exp 17 Automotive Engine

contributing factors to road load  
conversion of road velocity to engine speed: associated issues of rotational friction and fuel efficiency  
required bhp for given road load (transmission, differential efficiencies)

full throttle hp as a function of speed for different gears - available hp for given speed - maximum attainable velocity

calculation of mep for four stroke cycle

calculation of energy content in fuel via hydrometer

familiarity with torque and power curves

### Exp 18 Cooling Tower

the purpose of a cooling tower

methods to calculate energy and mass balance

how to determine humidity ratio, relative humidity, and enthalpy of moist air from wet bulb, dry bulb measurements - i.e. how to read and use a psychrometric chart.

definitions of heat load, range, and approach to wet bulb.

Ntu, effectiveness method of characterizing a cooling tower as a heat exchanger

influence of air flow and water flow rates on performance

propagation of uncertainties from temperature measurements to energy and mass balance relations.