EEL4936/6936 – Power Plant Engineering

Homework #4: Prime Movers

Due: 03/02/09

#1. A steam turbine stage, the design where pressure drops only across the fixed nozzle and not across the moving buckets is;

A. Reaction Turbine
B. Impulse Turbine

#2. A turbine installation where there are two LP turbines connected on a common shaft driving one generator is known as a;

A. Tandem compound turbine
B. Cross compound turbine

#3. The valve that is used to control steam flow to the HP section turbine for control during full load operation is known as the;

A. The Governor Valve
B. The Intercept Valve
C. The Stop Valve
D. The Throttle Valve

#4. Purpose of the Turbine turning gear is to rotate the turbine during shutdown and startup to;

A. Prevent bowing of turbine rotor due to weight of rotor
B. Build up oil film in journal bearings
C. Prevent bowing of turbine rotor due to uneven heating
D. Check for rotor rotation direction.

#5. The type of turbine control that refers to the sequential opening of the steam control (governor) valve (partial arc admission) is;

A. Throttle control
B. Governing control
C. Variable pressure control

#6. The four parts of the Brayton combustion cycle are;

_____
_____
_____
_____

#7. Using the following formula for compressor efficiency for a combustion turbine generator;

$$\eta_{comp} = \frac{h_{2S} - h_1}{h_2 - h_1}$$

Determine Compressor efficiency if;

H1 = 250 BTU/lbm
H2 = 1250 BTU/lbm
H2S = 1000 BTU/lbm

A. 0.75
B. 1.00
C. 1.25
D. 1.33

#8. Given the formula for Hydroturbine power below, What is the power developed (in HP) by a hydroturbine if the net head of water is 250 feet, turbine discharge flow is 1000 ft3/s, and turbine efficiency is 0.8?

P = (H * Q * n) / 8.81

Where Turbine output (HP)
H = net head (ft)
Q = turbine discharge (ft3/s)
N = turbine efficiency

A. 10,700 HP
B. 18,100 HP
C. 22,700 HP
D. 27,200 HP

#9. Using the table shown below; If the power developed by a turbine with a head of 200 feet is 20,000 HP and the head is reduced to 100 feet, what is the new HP developed by the hydroturbine?

TABLE 3.5.1 Proportionality Laws*

Constant head	Constant runner and diameter	Variable runner, diameter, and head
$P \propto D^2$	$P \propto H^{3/2}$	$P \propto D^2H^{3/2}$
$n \propto \frac{1}{D}$	$n \propto H^{1/2}$	$n \propto \frac{H^{1/2}}{D}$
$Q \propto D^2$	$Q \propto H^{1/2}$	$Q \propto D^2H^{1/2}$

*P = turbine output, hp (kW)
D = runner discharge diameter, ft (m)
n = turbine rotating speed, rpm
Q = turbine discharge, ft^3/s (m^3/s)
H = net head, ft (m)

A. 4,400 HP
B. 7,070 HP
C. 11,300 HP
D. 20,000 HP

#10. For a four stroke Gas or Oil reciprocating engine it takes how many shaft revolutions to complete on full cycle?

A. one
B. two
C. three
D. four