	Kafr El-Sheikh UNIVERSITY FACULTY OF ENGINEERING DEPARTMENT OF MECHANICAL ENGINEERING			
	EXAMINATION FOR FRESHMEN (2018 YEAR), STUDENTS OF 3th GRADE MECHANICAL POWER			
	COURSE TITLE:	**Thermal power stations (1)**		COURSE CODE: **MEP3111**
DATE:	January 16, 2019	TERM: 1st	TOTAL ASSESSMENT MARKS: 75	TIME ALLOWED (HOURS): 3

Use of tables and charts of steam is allowed. مسموح باستخدام خريطة و جداول البخار
Answer the following questions. Assume any necessary assumptions.

Question (1) (15 Marks)(a1,a14,)

For every point of the following, state: True or False and correct the False

1- The decrease of reheat pressure increases the quality of steam at turbine exhaust.
2- Mean temperature of heat addition is decreases due to Regeneration.
3- Rankine efficiency of a Steam Power Plant improves in summer as compared to that in winter.
4- The natural draught is produced by centrifugal fan.
5- An air preheater is installed between the economizer and chimney.
6- The purpose of super heater in a boiler is to increase the temperature of feed water for better efficiency.
7- Spray ponds are used to cool the warm water coming from the condenser in large power plants.
8- In impulse turbine the degree of reaction is zero, so there is enthalpy drop in moving blades.
9- The draught or pressure difference for a chimney of height of H meters is given by $\Delta p=gH(\rho_g-\rho_a)$.
10- A steam nozzle converts heat energy of steam into mechanical work.
11- The ratio of the useful heat drop to the isentropic heat drop is called nozzle efficiency.

Question (2) (10 Marks)(c16,c18)

A regenerative Rankine cycle using steam as the working fluid and the condenser pressure is 80 kPa. The boiler pressure is 3 MPa. The steam leaves the boiler at 400°C. The mass rate of steam flow is 1 kg/s. The turbine efficiency is 88%. After expansion in the high-pressure turbine to 400 kPa, some of the steam is extracted from the turbine exit for the purpose of heating the feed water in an open feed-water heater, the rest of the steam is reheated to 400°C and then expanded in the low-pressure turbine to the condenser. The water leaves the open feed-water heater at 400 kPa as saturated liquid. **Determine** the steam fraction extracted from the turbine exit, and cycle efficiency.

Question (3) (25 Marks)(a1,b1,b5,c16)

a- How can we improve the boiler efficiency? Mention the parameters which effect on natural water circulation in the boiler?

b- 500 MW power plant operates with overall efficiency 30%, thermal cycle efficiency 38%. An analysis of coal gives a higher heating value of 42000 kJ/kg. The analysis of coal gives 10% H_2 and the analysis of the flue gas gives the mass of CO is 0.05 kg/kgf and refuse coal is 0.1195 kg/kgf. The atmospheric air conditions are 50 °C, 0.942 bar, and the relative humidity of 50 percent. The exhaust gas is at 300 °C and 0.891 bar. CP (dry flue gases)= 1.05 kJ/kg °C and the specific heat of water vapour is 1.926 kJ/kg °C. The power required for forced fan is 3000 kW with fan efficiency is 85% and the pressure rise across forced fan is 63 cm water.

a) Draw up the heat balance sheet on the basis of one kg of dry coal fired.

b) The power required for induced fan efficiency is 85%.

Take $h_s - h_w = 2492.6 + 1.926T_{go} - 4.187\,T_{gi}$

Question (4) (15 Marks)(c18,a14)

a)What is the effect of air leakage on condenser performance? Explain how can we remove it?

b) The following data relates to a two pass surface condenser:

Steam condensed	= 15400 kg/h
Condenser vacuum	= 675 mm Hg
Barometer reading	=755 mm Hg
Inlet cooling water temperature	=15 °C
Exit cooling water temperature	=30 °C
Condensate temperature	= 32 °C
Quality of exhaust steam	=0.92
Water velocity in the tubes	= 2.6 m/s
Outside diameter of the tubes	=2.8 cm
Thickness of the tubes	=0.03cm
Heat transfer coefficient	= 3.35kJ//h/cm^2/°C

Determine 1- area of the tube surface required 2- number of tubes 3- length of tubes.

Question (5) (10 Marks)(b5,c16)

Steam enters an impulse turbine in which all processes are assumed to be reversible adiabatic. The inlet pressure and temperature are 7 bar and 420 °C respectively. Exhaust pressure is 1.1 bar. Nozzle exit angle 20^0. Blade speed ratio is 0.5. Blade exit angle is 50^0. **Determine** the blade efficiency of this turbine.