Kafrelsheikh University
Faculty of Engineering
Dept. Mech. Engineering
Year: 4th Year Mechanical power Eng.
Subject: (MEP4022) Thermal Power Stations (2)

Semester: 1st Semester
Final Examination
Date: 21 /01/2019
Time allowed: 3 hours
Full Mark: 75

(a) This exam measures ILOs no.: a. 8, b.2, b.7, C3, and C8
(b) No. of questions: 10 - No. of pages: 2
(c) This is a close book exam. *Non-programmable calculators, Thermodynamics tables, and Steam Chart* are allowed.
(d) Clear, systematic answers and solutions are required. In general, marks will not be assigned for answers and solutions that require unreasonable (in the opinion of the instructor) effort to decipher.
(e) Ask for clarification if any question statement is not clear to you.
(f) Attempts in all questions.
(g) The weight of each problem is indicated.
(h) Assume any missing data.

Answer the following:

Question 1: (15point)

1--Define: Plant Operating Factor, Utility Factor, **and diversity factor?**

2-How does the air leakage affect the condenser performance?

3-How is the water level in steam drum controlled?

4-Explain the operation of a spray – type desuperheater?

5-Explain the steam temperature control by gas recirculation. What is the gas tempering?

Question 2: (15point)

1-A thermal power plant consists of two 50 MW units, each running for 8000 hrs, and one 30 MW unit running for 2000 hrs per year. The energy produced by the plant is 80×10^7 KWh per year determine the plant load factor and plant use factor. Consider the maximum load as equal to the plant capacity.

2-A generating unit of 10 MW capacity supplies the following loads:

(a)Domestic consumers with a maximum demand of 6 MW at a load factor of 20%.
(b)Small industrial load with a maximum demand of 3.6 MW at a load factor of 50%.
(c)Street-light load with a maximum demand of 400 kW at 30% load factor.

Find the overall cost of energy per kWh for each type of consumer using the following data: Capital cost of the plant = SR 10,000 per k W, Total running cost = SR 36,00,000 per year, Annual rate of interest and depreciation on capital cost = 10%

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Question 3: (25point)

1-Steam enters the condenser at 35°C. The condenser vacuum is 70 cm of mercury when the barometer reads 75.5 cm of Hg. Determine the vacuum efficiency. Estimate the mass of air present in the condenser per kg of steam.

2-The following observations were recorded during a test on a steam condenser:

Barometer reading	**= 76.5 cm of Hg**
Condenser vacuum	**= 71. Cm of Hg**
Mean condenser temperature	**= 35 °c**
Temperature of hot well	**= 28 °c**
Quantity of cooling water	**= 60000 kg/hr**
Condensate collected	**= 2000 kg/hr**
Temperature of cooling water at inlet	**= 8 °c**
Temperature of cooling water at outlet	**= 24 °c**

Determine 1) the vacuum, corrected vacuum. 2) the efficiency of condenser , the vacuum efficiency 3) the under cooling of the condensate 4) quality of steam entering the condenser 5) mass of air present per m3 of condenser volume and per kg of uncondensed steam.

Question 4: (20point)

Design a tubular type air preheater, where the feed-water from the high pressure heater enters the inlet of the economizer at the rate of 600 kg/s and at 140 bar,170 °c. flue gases flow at the rate of 1250 kg/s and leave the economizer at 450 °c. The flue gases flow through the tubes of preheater are cooled to 160 °c and air entering at 35 °c flows outside the tubes at the rate of 1167 kg/s. the inlet velocity of flue gases is 13 m/s and the tubes are of 60/65 mm. if the overall heat transfer coefficient is 30 w/m^2 k, assume the flue gases behave as an ideal gas having C_p= 1.1 and R =0.287 kJ/kg k.