Mansoura University Faculty of Engineering Electrical Engineering Dept. Power Station Economics (B2111)		MSc preparatory Year Sept. 2013 Time : 3 Hours Full Mark : 100
Final Examination		

Q3 : (25 degrees)

Assume that the fuel inputs in MBtu per hour for units 1 and 2, which are both on-line, are given by

$$H_1 = 8P_1 + 0.024\,P_1^2 + 80$$

$$H_2 = 6P_2 + 0.04\,P_2^2 + 120$$

where

H_n = fuel input to unit n in MBtu per hour (millions of Btu per hour)

P_n = unit output in megawatts

a. Plot the input-output characteristics for each unit expressing input in MBtu per hour and output i megawatts. Assume that the minimum loading of each unit is 20 MW and that the maximum loadin is 100 MW.

b. Calculate the net heat rate in Btu per kilowatt-hour, and plot against output in megawatts.

c. Assume that the cost of fuel is 1.5 $/MBtu. Calculate the incremental production cost in $ /MWh o each unit, and plot against output in megawatts.

d. Disuss the meaning and usage of the plotted three curves .

Q4 : (25 degrees)

a. Define the factors affecting the calculations of the levelized energy cost (LEC) which is defined a the price at which electricity must be generated from a specific source to break even over the lifetime of the project.

b. Based on above definitions, try to arrange the following sources in an ascending order conventional steam burning heavy fuel oil (HFO), conventional steam burning coal, nuclear units wind power, solar pv, solar thermal, combined cycle burning NG, open cycle gas turbines burning NG .

This exam is on (3) pages

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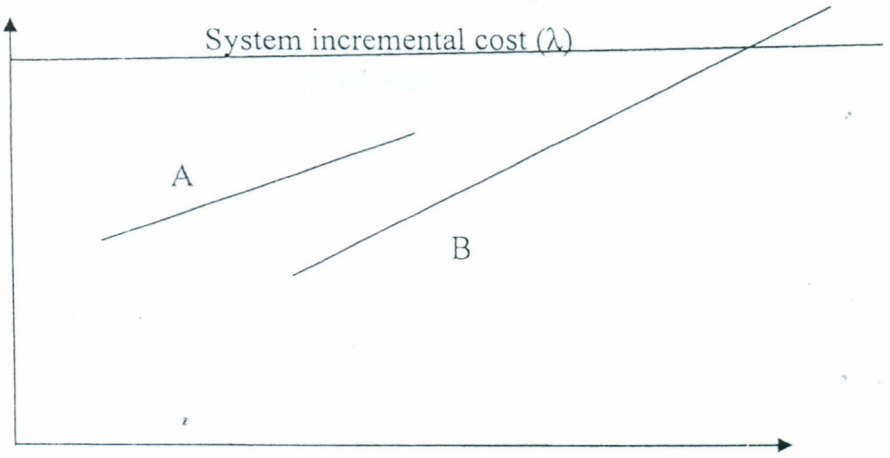
VI.



The two curves represent the Incremental Heat Rate (IHR) for two units A & B where:

$P_{Amin} \leq P_A \leq P_{Amax}$ and $P_{Bmin} \leq P_B \leq P_{Bmax}$

The loading of the two units based on the system (λ) shown are:

a) Unit A at P_{Amin} and Unit B at P_{Bmax}
b) Unit A at P_{Amax} and Unit B at P_{Bmin}
c) Unit A at P_{Amax} and Unit B at P_B (point of intersection of system (λ) and IHR curve of unit B)
d) None of the above.

Q2 : economic dispatch (25 degrees)

The fuel cost for the three thermal plants in $/hr is given by:

$$C_1 = 500 + 5.3P_1 + 0.004 P_1^2$$

$$C_2 = 400 + 5.5P_2 + 0.006 P_2^2$$

$$C_3 = 200 + 5.8P_3 + 0.009 P_3^2$$

Where P1, P2 and P3 are in MW. The total load is 975 MW. The generator limits (in MW) are:

$$200 \leq P1 \leq 450$$

$$150 \leq P2 \leq 350$$

$$100 \leq P3 \leq 225$$

a) Neglecting transmission losses, find the optimal dispatch and the total cost.
b) Discuss the impact on the economy and security of the operation if losses are included.

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Attempt all the following questions:

Q1 : Choose the correct answer (25 degrees)

I. The Project is considered feasible if:-

a) Debt ratio > Equity ratio.
b) Debt ratio < Equity ratio.
c) Debt ratio = Equity ratio.
d) None of the above.

II. Working capital is a measure of the project success if it is:-

a) Working capital > 0.
b) Working capital < 0.
c) Working capital = 0.
d) None of the above.

III. Capacity charge is intended to collect the following expenses on the projects;-

a) Capital investment [CAPEX].
b) Operating cost [OPEX].
c) Both of the above.
d) None of the above.

IV. 300 MW power plant can generate yearly energy production based on 90% availability factor & 85% capacity factor.

a) 3,220,325 MWh.
b) λ2,010,420 MWh.
c) 1,750,221 MWh.
d) 1,873,515 MWh.

V. What is the base to calculate the excess cash:-

a) Cash from operation.
b) Cash from financing activities,
c) Cash from investment.
d) All the above.