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| **An-Najah National University**  **Engineering College** |  | | **جامعة النجاح الوطنية**  **كلية الهندسة** |
| **Energy Engineering and Environment**  **Energy Management (1/463610)** | | | |
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| **Student Name:………………………...** | | **Instructor Name: Dr. Mohammed Alsayed** | |
| **Registration Number:** | | **Academic Year:2019/2020** | |
| **Total Exam Mark: 50** | | **Semester: second** | |
| **Exam Weight: 40** | | **Credit Hours: 3** | |
|  | | **Date: 27/03/2019** | |
|  | | **Exam Duration: 120 minutes** | |

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| **Question** | **Points** | **ILO’s** | **Question Grade** |
| **Q1** | **25** |  |  |
| **Q2** | **5** |  |  |
| **Q3** | **20** |  |  |
| **Student Grade** | | |  |

**Note**: it is an open book exam.

**Q1 (25 points):** For the following hotel lighting system data:

|  |  |  |
| --- | --- | --- |
|  | Present system | Proposed system |
| Type | 196 fluorescent light fixtures | 140 LED lights fixtures |
| Size | 36 watt/lamp (4 lamps/fixture, 8% ballast) | 55 watt/fixture |
| Lamp life | 18,000 hours/lamp | 55,000 hours/lamps |
| Lamp cost | $4.5.00/lamp | $80.00/fixture (then 15$/lamp) |
| Operating hours | 8000 | 8000 |
| Tariff | 0.1 $/ kWh and 11 $/kW/month | |

1. Determine the estimated energy savings.
2. Determine the estimated power savings.
3. If the heating system (diesel fuel) is one for 1500 hours per year (36 MJ/L, 70% efficient, 850 gm/L, and 1.35 $/L). Calculate the cost deviation.
4. If the cooling system is on for 2500 hours per year (COP = 3.5), calculate the cost deviation.
5. Calculate the SPBP.

**Q2 (5 points):** A bank located at Nablus city where the average outside temperature during typical summer daylight period equals to 32 oC. The bank air conditioning system (ACS) is adjusted at 18 oC. However, an energy engineer (EE) suggested re-adjusting the ACS to work at 22 oC. Estimate the saving (%) that will be achieved according to the EE proposal.

**Q3 (20 point):** An ice cream factory has the following annual load (Bold data means on-peak months). Assume the load to be the same every year.

|  |  |  |  |
| --- | --- | --- | --- |
| Month | Load (kW) | Month | Load (kW) |
| January | 50 | **July** | **750** |
| February | 50 | **August** | **750** |
| March | 50 | **September** | **550** |
| April | 50 | **October** | **550** |
| May | 50 | November | 50 |
| **June** | **650** | December | 50 |

13 USD/kW (on-peak), 4.5 USD/kW (off-peak), 0.35 USD/kWh (on-peak), and 0.1 USD/kWh (off-peak).

1. Determine annual Ratchet penalty (70%) taking into consideration the power tariff provided.
2. If the factory operates 24 hours per day, 7 days per months during on-peak period. And only 4 hours per day, 5 days per week during off-period. Calculate the factory energy consumption.
3. Instead of using the given tariff, estimate the average kWh cost since the load is the same.
4. Discuss the feasibility of reducing the on-peak load by 200 kW and provide it from private diesel generators (36 MJ/L, 70% efficient, 850 gm/L, and 1.35 $/L).

**Good Luck**