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| **An-Najah National University**  **Engineering College** |  | | **جامعة النجاح الوطنية**  **كلية الهندسة** |
| **Energy Engineering and Environment**  **Energy Conservation and Auditing (1/10656301)** | | | |
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| **Student Name:………………………...** | | **Instructor Name: Dr. Mohammed Alsayed** | |
| **Registration Number:** | | **Academic Year: 2018/2019** | |
| **Total Exam Mark: 40** | | **Semester: second** | |
| **Exam Weight: 20** | | **Credit Hours: 3** | |
|  | | **Date: 18/03/2019** | |
|  | | **Exam Duration: 60 minutes** | |

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| **Question** | **Points** | **ILO’s** | **Question Grade** |
| **Q1** | **5** |  |  |
| **Q2** | **5** |  |  |
| **Q3** | **15** |  |  |
| **Q4** | **15** |  |  |
| **Student Grade** | | |  |

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

**Q1 (5 point):** Knowing that diesel fuel costs 5.5 Nis/L, has a density of 850 g/L, and energy content equals to 36 MJ/L. Anew 5 kW diesel generator (35% efficient) costs 5,500 Nis and lasts for 10 years. A shop owner is thinking about buying it. He needs it for 12 hours per day, 6 days per week, and 50 week per year. On average, the shop electric load equals to 4 kW. Assuming the annual interest rate equals to 10% per year, calculate the cost per unit produced (Nis/kWh).

**Q2 (5 point):** Average Palestinian house consumes around 5,000 kWh per year. How many kg’s of coal is required (per year) to be burned in order to electrify such a house. Assume each coal kg contains 22 MJ.

**Q3 (15 point):** having a typical kitchen electric water heater (1.8 L capacity).

1. Estimate the cost of heating 1.8 L of water from 20 oC to 100 oC knowing that electric cost 0.6 Nis/kWh and heater efficiency equals to 0.92.
2. If you know that completing the process described in (a) took 3.5 minutes. Estimate the power of the heater.
3. Compare electric water heater feasibility with gas cooker (0.7 efficient, 38 MJ/m3, 4.2 Nis/m3)

**Q4 (15 point):** An ice cream factory has the following annual load (Bold data means on-peak months). **Determine** annual Ratchet penalty taking into consideration the power tariff provided. **Now**, if the factory operates 24 hours per day, 7 days per months during on-peak period. And only 4 hours per week, 5 days per week during off-period. Discuss the feasibility of reducing the on-peak load by 200 kW and provide it from private diesel generators (1.35 USD/L, 36 MJ/L, and 35% efficient).

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| Month | Load (kW) | Month | Load (kW) |
| January | 50 | **July** | **572** |
| February | 50 | **August** | **572** |
| March | 50 | **September** | **572** |
| April | 50 | **October** | **572** |
| May | 50 | November | 50 |
| **June** | **572** | 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).