The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	**MASTER OF TECHNOLOGY IN INDUSTRIAL ENGINEERING**
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX7125 - ENERGY MANAGEMENT IN INDUSTRIES**
Academic Year	:	2014/15
Date	:	17th September 2015
Time	:	0930 - 1230 hrs
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 6 questions.
3. Answer **Question 6** (28 marks) and **four** other questions (18 marks each).
   Question No. 06 is compulsory.

Q1.

a. Sri Lanka's dependency on imported fossil fuels has been increasing over the years, and now reaching crisis proportions. In your opinion should Sri Lanka face this situation as a THREAT or an OPPORTUNITY? Analyse the situation based on the current development in the energy sector both globally and locally with examples where relevant.

(10 marks)

b. What role Energy Efficiency and Renewable Energy can play in addressing this challenge?

(8 marks)

Q2.

Write short notes on four (04) of the following;

a. Energy efficient lighting
b. Energy management
c. Housekeeping methods to conserve energy in air conditioning
d. Fuel switching
e. Life cycle cost of electric motor

(4.5 marks each)

Q3.

a) Explain the term 'Power Factor' and its significance in controlling the Maximum Demand (Max. kVA) and reducing the cost of electricity of an organisation.

(9 marks)

b) Discuss low cost (or no cost) options that can be applied to reduce the maximum demand of an industrial establishment.

(9 marks)

Q4.

a) What are the major environmental pollutants emitted due to burning of fossil fuels? Explain in detail the negative impacts caused by each of these pollutants on the environment.

(9 marks)

b) Explain proven methods that can be applied to mitigate environmental impacts associated with each of the pollutants in an industrial set up.

(9 marks)

Q5.

a) Every employee in an organisation bears responsibility for efficient use of energy in that organisation. In this sense, compare the different and interactive roles expected to be played by different levels of staff, say Top, Middle and Low levels, in order to ensure efficient utilisation of energy in organisations.

(9 marks)

b) Based on answer to (a) above, what kind of scope and objectives would you suggest for capacity building/training programmes on energy efficiency for different level of staff in organisations? Give reasons to elaborate your answer.

(9 marks)

Q6. (Compulsory Question)

The Table A, attached, shows energy consumption and production data for 'Golden Leaf' tea factory in Ratnapura for the year 2014. The factory uses both electricity and firewood as energy sources in the production process of making Made Tea (MT), the final output. Electricity is taken from the national grid. Since, there were regular interruptions of grid electricity, the management of the factory bought a diesel generator at the end of 2013 and put into use immediately. Heat energy, produced by burning firewood in a furnace, is used to generate hot air to dry moist processed tea in a dryer.

Table A shows the performance for the year 2014, giving monthly grid electrical energy consumption in kWh, monthly diesel consumption in liters, monthly firewood consumption in kilo grams (kg) and monthly production of Made Tea (final output) in kilo grams (kg).

The Golden Leaf tea factory management was aware that the industry benchmarks for energy utilization were as follows;

Electrical energy   - 0.63 kWh/kgMT
Firewood (FW)   - 1.78 kgFW/kgMT

Answer the following questions.

a) Calculate monthly electrical energy supplied by the diesel generator and enter in column A, and fill up column B accordingly.
(Hint – 1 liter Diesel = 2.75 kWh)

b) Calculate monthly energy performance indicators, i.e. Specific Electrical Energy Consumption (kWh/kgMT) and Specific Firewood Consumption (kgFW/kgMT), for Golden Leaf and enter in columns C and D respectively.

c) What are the annual average energy performance indicators of Golden Leaf for both electrical energy and firewood for 2014?

d) Estimate the annual potential for saving electrical energy and firewood, if Golden Leaf improves their energy performance to industry benchmark levels. This can be based on 2014 production figures.

Important:

No need to construct the Table A anew. You may use the given table itself to answer the questions where relevant. Additional copies of Table A will be provided if necessary. Attach your completed Table A to your answer script.

(28 marks)

_____END OF QUESTION PAPER_____

Table A: Energy consumption and production data for Golden Leaf tea factory for 2014

Month	Electricity Consumption					Firewood Consumption	Production	Specific Energy Consumption	
	Grid Electricity		Diesel Use	Diesel Generator Electricity	Total			Electricity	Firewood
	kVA	kWh	Liters	kWh	kWh	kg	kg MT	kWh/kgMT	kgFW/kgMT
				A	**B**	**C**			**D**
Jan	96	42,290	142.5			126,073	52,419		
Feb	100	37,740	55.0			98,273	46,794		
Mar	88	30,180	136.5			76,311	38,319		
Apr	90	32,280	247.0			86,458	41,149		
May	120	51,340	191.0			158,460	81,324		
June	158	39,240	551.0			126,073	48,821		
July	94	42,800	172.0			139,278	61,273		
Aug	97	39,950	587.0			107,586	50,823		
Sep	121	44,460	647.0			132,606	63,414		
Oct	125	42,570	348.0			139,834	53,488		
Nov	100	35,593	362.0			98,968	45,883		
Dec	94	39,210	90.0			104,806	43,490		