PGDM/PGDMIB 2012-14

ENERGY MANAGEMENT

DM-542/IB541

Trimester-IV, End-Term Examination: September 2013

Time allowed: 2 Hrs. 30 Min Max Marks: 50

Roll No: _____

Instruction: Students are required to write Roll No. on every page of the question paper. Writing anything except the Roll No. will be treated as **Unfair Means.** In case of rough work, please us answer sheet.

Section A: Short questions:

Please answer any three out of the five questions. Each question carries 5 marks. Write your answers in about 50 words per answer.

A-1 What is the difference between Refractory material and Insulation material in a thermal system

A-2 Write at least five areas in a HVAC system which can help save energy in a HVAC system.

A-3 Write at least three types of cooling towers and their major performance measuring parameters.

A-4 Why do we need to treat water before feeding it in to the boilers.

A-5 Explain the term FBC and write at least five advantages of fluidization of fuels. Give three examples of fuels which can be used in FBC system.

Section B: Long questions: **20 Marks**

Please answer any two out of the three questions. Each question carries 10 marks. **Write your answers in about 500 words per answer.**

B-1 How does a waste heat recovery device increase energy efficiency and save costs. Give two examples in BIMTECH campus, where such waste heat recovery systems can be effectively used.

B-2 What is the EC Act 2001 and role of BEE. Write five most important features of the EC Act 2001.

B-3 What are the roles and responsibilities of (a) Energy Auditor and (b) Energy Manager.

Section C: **15 marks**

Case study: The case:

Cheap and reliable electricity for industrial use was one of South Africa's most important competitive advantages. This is no longer the case. In January 2008, huge blackouts occurred throughout the country. The national grid almost crashed. In order to prevent this, the Department of Minerals and Energy of South Africa implemented an urgent Power Conservation Program, in which top electricity consumers were expected to reduce 10% electricity *consumption compared with the reference annual consumption from October 2006 to* September 2007.

In South Africa, coal-fired power stations supply 92% of electricity and the corresponding carbon emission makes South Africa's CO2 emission per unit of GDP among the highest in the world. The main electricity supplier Eskom had increased its electricity tariffs in 2009 and was expected to continue to increase the tariffs in the following years.

This financial service company was very proactive to reduce 10% of its energy consumption following the request of the Power Conservation Program. In October 2008, a branch company has suffered a one week long power outage. Based on the justifications of power outage threats, environmental concerns, the energy saving incentives, the Power Conservation Program, and the experience of economic losses in the one week power outage, this financial service company committed to have backup power at key sites to minimize the impact of power outages. However, they realised that such a decision to install a power back up facility like this was a costly affair, they decided to implement an extensive energy management program to improve energy efficiency.

The energy management program of the company focussed on the investment of back up power, the purchase of energy efficient equipment, the adjustment of air conditioner settings, the building management system, variable speed drives, power factor correction, computer energy saving settings, lighting retrofit, and motion sensors. Therefore, the energy demand and production of the company have not been affected by the program, the energy consumption and energy cost have been reduced, and the green house emission has been decreased accordingly.

The reduction of energy consumption was mainly due to the energy efficient equipment and the control of energy waste.

The conceptual levels at which this company planned the energy management initiatives were,

- Technology efficiency

The analysis of the electricity consumption showed that air-conditioning was the largest consumption area and accounted for about 40% of the total energy, followed by lighting at 28%, office equipment at 20% and water heating at 8% respectively. The initiatives included variable speed drive, the online energy alerting software PowerWatch based on telemeters, and the fluorescent lighting control system LightEco Plus amongst others.

• Equipment efficiency

Since technology efficiency helps to determine that energy efficient lights, motion sensors, variable speed drives, power factor corrections, etc, were the main technology used in the program, the relevant equipment was installed, e.g. incandescent lights replaced by compact fluorescent lights, cathode ray tube (CRT) computer monitors replaced by liquid crystal displays (LCD), and power factors corrected to reduce the maximum demand (MD) charge. New equipment was installed. This included the installation of intelligent telemeters to collect real time energy consumption information, replacement of air-conditioning fan motors, installation of the Building Management System, LightEco Plus control system, variable speed drive motors for fans, geyser timers and window films or louvers, etc. Insulation from roofs to walls and windows, and double glazing on the windows were adopted to reduce heat exchange through building envelopes. Inefficient equipment, such as starters and deactivate capacitors in old light fittings and high power factor magnetic or electronic ballasts, were removed.

Some of the technologies identified through technology efficiency investigation have been implemented, for instance, solar geysers, photovoltaic systems, and heat pump water heaters are installed; some of the air-conditioners, chillers and boilers are upgraded into energy efficient ones. Advanced building automation systems were planned to be investigated to optimally and dynamically change the air-conditioning temperature set point according to real time weather conditions and occupancy level, energy rate, and energy consumption saving objectives amongst others. Wind turbines, geothermal heat pumps, air to air heat pumps, etc, were also considered as good options which were slated to be further tested to improve energy efficiency. Equipment efficiency was planned to be improved by the development and implementation of a well designed equipment maintenance plan.

• Operation efficiency:

The operation efficiency was improved in many aspects, e.g. air conditioning temperature settings were set at 26 deg. C; elevators were switched off at night; one chiller was switched on after 11:00 am; computers were remotely shut down at non-working hours, and motion sensors were installed to switch off unnecessary lights during un-occupied hours. During the design of new buildings or the retrofitting of existing buildings, it was decided to design them in a way that

encouraged to use as much as possible natural light filtering into the buildings. In order to take a good advantage of skylights, the farthest distance of a workstation from a perimeter window or light well was fixed as 15 meters. Automated Shut Down software and other energy saving settings were installed in computers, and these brought R100 to R250 electricity saving per computer per year. Relevant staff was also trained to efficiently use office equipment, control the geyser timers and set the air-conditioner temperatures.

• Performance efficiency

The company had extended backup power storage to reduce the risk of power outage. The commercial buildings were classified into different categories like Strategic function, Front line function and Cheque processing, and Support function. Accordingly, the minimum standby capacity for different functioning categories were established.

Questions: Answer the following three questions. Each question carries five marks.

i) Write down, with examples, three types of energy sources used in an academic institution like BIMTECH, and suggest one way to reduce the consumption in each one of them.

ii) Suggest at least five types of energy conservation devices or equipment that can be installed in an academic institute,

iii) What is POET approach and how do you think the principles of POET approach can be implemented in a domestic situation.