Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

II SEMESTER M.TECH ENERGY MANAGEMENT AUDITING & LIGHTING

END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: ENERGY AUDITING & MANAGEMENT [ELE 504]

REVISED CREDIT SYSTEM

Time: 3 Hours 07 MAY 2016 MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** questions.
- Missing data may be suitable assumed.

1A. Define Energy Auditing as per Energy Conservation Act, 2001. List the various auditing methodologies. ***02***

1B. A food containing 80% water is to be dried at 100 °C, down to moisture content of 10%. If the initial temperature of food is 16 °C, calculate the quantity of heat energy required per unit weight of original material, for drying under atmospheric pressure. The latent heat of vapourization of water at 100 °C and at standard atmospheric pressure is 2257 kJ/kg. The specific heat capacity of the food is 3.8 kJ/kg °C and of water is 4.186 kJ/Kg °C. Find also the energy required/kg water removed. ***03***

1C. Write a short technical note on how Energy security can be achieved considering the present Energy Scenario of India. Clearly highlight the existing status of Energy security of India and explain three methods to overcome the shortfalls. ***05***

2A. A fertilizer plant consuming 100TPH of saturated steam at 45 kg/sq.cm pressure has been using Indian coal as fuel to the boiler and is now switching over to Imported coal.
Typical ultimate analysis of the two types of coals:

Parameters	**Indian Coal (%)**	**Imported Coal (%)**
Carbon	41.11	58.96
Hydrogen	2.76	4.16
Nitrogen	1.22	1.02
Oxygen	9.89	11.88
Sulphur	0.41	0.56
Moisture	5.98	9.43
Ash	38.63	13.99
GCV (kcal/kg)	4000	5900

Boiler efficiency with Indian coal = 75%
Boiler efficiency with Imported coal = 82%
Oxygen content in flue gases with Indian coal = 10%
Oxygen content in flue gases with Imported coal = 4%

Assuming that the flue gas temperature is 200°C, the ambient temperature is 30°C, enthalpy of steam is 668kCal/kg, feed water temperature is 80°C and specific heat of flue gas is 0.23, determine

a. Coal requirement in each case.
b. Calculate the percentage dry flue gas losses in both cases **08**

2B. During the auditing of a 75 kW four pole induction motor operating at 49.8 Hz and rated for 415 V and 1440 RPM, the auditor measured the actual speed to be 1470 RPM and applied voltage to be 428 V. Determine the percentage loading of the motor. ***02***

3A. In a brewery chilling system, ethylene glycol is used as secondary refrigerant. The designed capacity is 40 TR. A test was conducted to find out the operating capacity and energy performance ratios. The flow was measures by switching off the second pump and measuring the tank level difference in hot well. The measured data is given below

- Temperature of ethylene glycol entering evaporator = (-) 1 °C
- Temperature of ethylene glycol leaving evaporator = (-) 4 °C
- Ethylene Glycol flow rates = 13200 kg/hr
- Evaporator ethylene glycol pressure drop (inlet to outlet) = 0.7 kg/cm2
- Power input to compressor electrical power, kW = 39.5 kW
- Specific Heat Capacity of Ethylene glycol = 2.34 kCal/kg °C

Determine (i) Net Refrigeration Capacity, (ii) kW/ton , (iii) Coefficient of Performance & (iv) EER ***04***

3B. During Jan-2016, a plant has recorded a maximum demand of 900 kVA and an average power factor of 0.8 lag is observed. The minimum average power factor to be maintained is 0.95 lag as per the independent utility supplier & every dip of 1% power factor with respect to the minimum power factor to be maintained, attracts a penalty of Rs 10,000/- in each month's electricity bill.

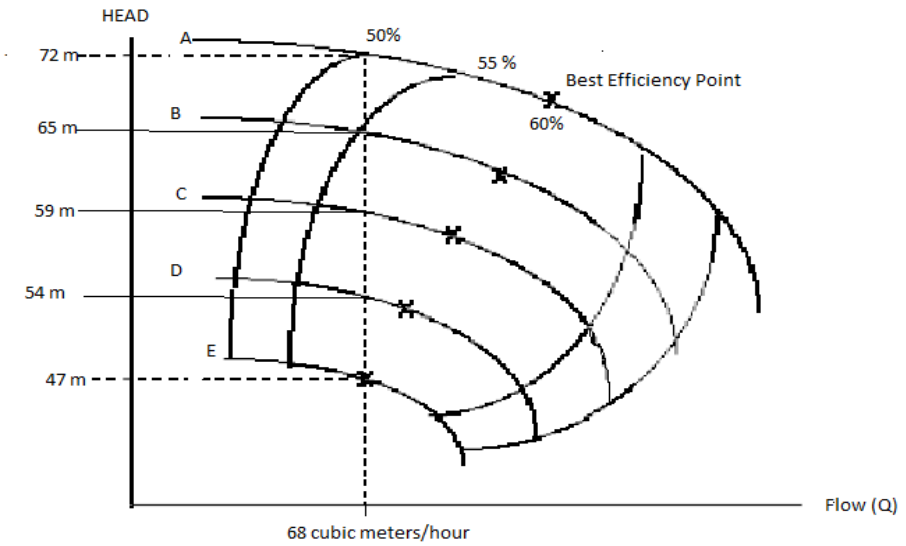
a. Calculate the improvement in power factor for Feb, 2016 by installing 150 kVAR capacitors.
b. Calculate penalty to be paid, if any, for the month of Feb, 2016. ***03***

3C. Explain any three Energy Conservation measures for Lighting systems. ***03***

4A. An industrial process requires a flow of 68 m^3/hr at 47 m head. The demand is being met using a centrifugal pump A, which is connected to an Industrial 3 Phase Induction Motor, having an efficiency of 85%. The pump is operated for 12 hours throughout the year.

a) Compute the total power drawn by the motor, driving pump A.
b) Suggest the best possible recommendation to improve the energy efficiency of the system.

[Refer the pump characteristic curves & related data shown below]. Compute the payback period for the recommendation given. [Assume energy cost to be INR 6/- per unit]



05

4B. A 34 kW/45 HP, 415 Volt Delta connected 3 Phase IM has a full load current of 57 A at 1475 RPM. The No Load Test yielded the following result;- V = 415 V; No load current = 16.1 A, Frequency = 50 HZ; Stator phase resistance at 30 °C = 0.264 Ohms & No Load power = 1063.74W.

Determine

a) Calculate the Core + Friction & Windage losses
b) Stator copper losses if the operating temperature is 120 °C.
c) Full load slip & rotor input ; Motor input assuming IEC standard for stray losses
d) Motor efficiency at full load & full load power factor. ***05***

5A. A textile dryer is found to consume 4 m^3/hr of natural gas with a calorific value of 800 kJ/mole. If the throughput of the dryer is 60kg of wet cloth per hour, drying it from 55% moisture to 10% moisture, estimate the overall thermal efficiency of the dryer taking into account the latent heat of vaporization only. ***04***

5B. With a neat diagram, explain the working of a Hot Wire Anemometer. ***03***

5C. Explain how the Electricity Act, 2003 has ensured a qualitative transformation in the field of Energy Sector. ***03***

6A. Explain the 5S management principle with respect to its significance, implementation technique and potential benefits. ***03***

6B. The Diesel Generator set installed behind the MIT Cafeteria yielded the following data during a one year energy monitoring program.

Month	**Diesel Consumption (liter)**	**Electrical Energy (KW-hr)**
March, 2013	4045	14108
April, 2013	4240	14620
May, 2013	1475	5193
June, 2013	985	3325
July, 2013	280	932
Aug, 2013	170	500
Sept, 2013	220	797
Oct, 2013	1465	5217
Nov,2013	415	1454
Dec, 2013	120	367
Jan, 2014	280	983
Feb, 2014	765	2595

Using linear regression technique, determine the equation of the best fit line for the data given to predict the amount of diesel required if Electricity Generation for the month of March, 2014 is 15000 kWhr. ***04***

6C. Explain the design improvement which make an energy efficient motor, more efficient than a standard motor of the same capacity. ***03***