Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

II SEMESTER M.TECH (TSES) END SEMESTER EXAMINATIONS

APRIL/MAY 2017

SUBJECT: ENERGY AUDIT & MANAGEMENT [MME 5241]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date : 20 April 2017** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. What is energy audit? What are its objectives? Explain in brief the activities involved in detailed energy audit ***(05)***

1B. Explain how the Electricity Act, 2003 has ensured a qualitative transformation in the field of Energy Sector. ***(03)***

1C. Explain how daylight linked control and occupancy sensor control leads to increased energy efficiency in a lighting system. ***(02)***

2A. Explain the important properties of a good insulator. A small electric heating application uses a wire of 2 mm diameter with 0.8 mm thick insulation (k= 0.12 W/mK). Heat transfer coefficient of outside air is 35 W/m^2K. Determine the critical thickness of insulation. Also find the percentage increase in heat transfer rate if the critical thickness is used, assuming the temperature difference between the surface of the wire and surrounding air remains unchanged. ***(05)***

2B. A community has 500 people. The source of water for the community are bore wells& supply of water from bore well is through hand pumps. Six hand pumps are used to meet the water requirement. Using the following details, compute the cost of water per liter if the project life cycle is 20 years.

- Per capita water consumption – 40 lit/day
- Cost of each hand pump – INR 5000 ; Life span of a hand pump = 10 years
- Depth of bore well – 20 m; Cost of digging the bore well – INR 250 per meter.
- Annual Maintenance Cost – INR 1250/- per hand pump
- Rate of interest = 10%; Inflation Rate - 7%

(05)

3A. Discuss briefly how the efficiency of a furnace can be determined by indirect method. Give the relevant equations also ***(05)***

3B. With a neat diagram, briefly explain the power stages of a 3 phase Induction Motor.
A 34 kW/45 HP, 415 Volt Delta connected 3 Phase Induction Motor 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 motor efficiency at full load, and also the full load power factor. (Assume IEC standard for stray losses) ***(05)***

4A. With a neat sketch explain the construction and working principle of Heat wheel.
With sketches differentiate between topping and bottoming cycle of cogeneration systems ***(05)***

4B. Seafresh Food Corporation, Cochin is involved in the business of processing and canning seafood, which is then exported to different countries. Its energy consumption and production data was collected for the duration November, 2012 till April, 2014. During the month of July 2013, energy efficient motors and waste heat recovery systems were installed. ***(05)***

Month	Monthly Energy Consumption			Monthly Production
	(toe/month)			(Tonnes/month)
	HSD	Electricity	Coal	
Nov, 2012	130	190	20	380
Dec, 2012	110	210	20	440
Jan, 2013	100	270	10	460
Feb, 2013	100	270	10	520
Mar, 2013	120	175	05	320
Apr, 2013	120	360	20	520
May, 2013	80	200	00	240
June, 2013	100	300	24	620
July, 2013	100	300	20	600
Aug, 2013	120	270	10	560
Sept, 2013	100	255	05	440
Oct, 2013	105	210	15	360
Nov, 2013	110	225	05	420
Dec, 2013	88	240	12	420
Jan, 2014	136	200	36	480
Feb, 2014	90	258	32	540
Mar, 2014	80	190	10	280
Apr, 2014	100	270	10	500

Perform CUSUM analysis to calculate the energy savings due to installation of energy efficient motors & waste heat recovery systems.

5A. Following are the data collected for a typical oil fired boiler. Find the efficiency of the boiler by indirect method. ***(05)***

Analysis of oil:C - 84%, S – 1.5%, H_2 -12%, O_2 -1.5%, N_2 - 0.5%, moisture - 0.5%

GCV:	10000 kCal/kg.
Fuel firing rate:	2648.12 kg/hr
Surface temperature of boiler:	80°C
Surface area of boiler:	90 m^2
Humidity:	0.025 kg/kg of dry air.
Wind speed:	3.8 m/s
% O_2 in the flue gas:	7.4%
% of CO_2 in the flue gas:	10.8%
Flue gas temperature:	190°C
Ambient temperature:	30°C
Specific heat of flue gases:	0.23 kcal/kg
Specific heat steam:	0.45 kcal/kg

5B. Skim milk is prepared by the removal of some of the fat from whole milk. This skim milk is found to contain 90.5% water, 3.5% protein, 5.1% carbohydrate, 0.1% fat and 0.8% ash. If the original milk contained 4.5% fat, calculate its composition assuming that only fat was removed to make the skim milk and that there are no losses in the process. ***(03)***

5C. During May-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 0.5% in power factor attracts a penalty of Rs 10,000/- in each month's electricity bill. If 160 kVAr capacitor was added in the month of June 2016, calculate penalty to be paid, if any, for the month of June 2016. ***(02)***