Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent Institution of MAHE, Manipal)

II SEMESTER M.TECH (TSES)

END SEMESTER EXAMINATIONS, APRIL 2018

SUBJECT ENERGY AUDIT & MANAGEMENT [MME 5241]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 17 April 2018** **Max. Marks: 50**

Instructions to Candidates:

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

1A. Define energy management energy conservation and energy audit. Explain in brief, duties and responsibilities of energy manager ***(05)***

1B. Explain Energy security and Energy Intensity. Discuss any two methods to improve the energy security of India ***(03)***

1C. Explain how reduction in feeder voltage is considered as an energy conservation measure for lighting systems. ***(02)***

2A. Distinguish between critical thickness of insulation and economic thickness of insulation

An electric cable of 12 mm in diameter is insulated to increase the current capacity. Due to insulation the current carrying capacity is increased by 15% without increasing the cable surface temperature above 70°C. Environmental temperature is 30°C. Assuming that heat transfer coefficient from bare as well as from the insulated cable is 14 W/m^2-K, calculate the conductivity of the insulating material. ***(05)***

2B. A PV array of 500W has been installed to pump water from bore well of 20 meters deep, using a submersible motor & pump system to an overhead tank. The length of the pipe required to pump the water is 30 m. Following are the costs involved for sub systems and their life spans:

- PV array- ₹ 400/watt; Life span - 15 years
- Motor & Pump system- ₹100/Watt; Life span – 8 years
- Water Tank = ₹. 45000; Life Span – 20 years
- Pipe cost-₹400/m; Life span – 5 yrs
- Cost of digging bore well – ₹ 500/m
- Maintenance cost – ₹ 3000/yr
- Misc. capital cost : ₹ 100/Watt
- Salvage Value – ₹ 20/- Watt

If interest rate is 10% and inflation is 6%, calculate life cycle cost of the water for the project period of 15 yrs. ***(05)***

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

3B. A 3 Phase 34 kW/45 hp, 415 Volt Delta connected Induction Motor has a full load current of 57 A at 1475 RPM. The No Load Test yielded the following result;- ***(05)***

Applied Voltage = 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) Core and Friction & Windage losses
b) Stator copper losses if the operating temperature is 120 °C.
c) Full load slip & Motor input at full load (assuming IEC standard for stray losses)
d) Motor efficiency at full load & full load power factor.

4A. With a neat sketch explain the construction and working principle of Heat pipe. With sketches explain gas turbine based cogeneration system giving its advantages and disadvantages over other systems. ***(05)***

4B. The Diesel Generator set installed behind the MIT Cafeteria yielded the following data during a one year energy monitoring program.

Month	**Diesel Consumption (lit)**	**Electrical Energy (KW-hr)**
March, 2016	4045	14108
April, 2016	4240	14620
May, 2016	1475	5193
June, 2016	985	3325
July, 2016	280	932
Aug, 2016	170	500
Sept, 2016	220	797
Oct, 2016	1465	5217
Nov,2016	415	1454
Dec, 2016	120	367
Jan, 2017	280	983
Feb, 2017	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, 2017 is 15000 kWhr. ***(05)***

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

Analysis of oil: C - 84%, S – 1.5%, H2 -12%, O2 -1.5%, N2 - 0.5%, moisture - 0.5%

GCV of oil	8300 kcal/kg
Fuel firing rate	2648.12 kg/hour
Surface temperature of boiler	80°C
Surface Area of Boiler	80 m^2
Humidity	0.025 kg/kg of air
Wind speed	3.8 ms^{-1}
% O_2 in flue gas	7%
% CO_2 in flue gas	10%
Flue gas temperature	220 °C
Ambient Temperature	27 °C
Specific heat of Flue gases	0.23 kcal/kg
Specific heat of steam	0.45 kcal/kg

(06)

5B. A textile dryer is found to consume 4 m3/hour of natural gas with a calorific value of 800 ***(04)***

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.