Reg. No.



I SEMESTER M.TECH (ENERGY SYSTEMS & MANAGEMENT)

END SEMESTER EXAMINATIONS, NOVEMBER 2019

ENERGY AUDITING [ELE 5153]

REVISED CREDIT SYSTEM

Time: 3 Hours	Date: 15 November 2019	Max. Marks: 50
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Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitably assumed.
- **1A.** What does Energy Security mean? Explain any two methods of improving energy security.

Table below encapsulates the details of Indian crude oil imports for the year 2013-14.

Country of Import	Quantity (kilo tonne)	Political Stability Index (b)	Share of domestic production (g)
Qatar	11579139	3.15	0.67
Yemen	513062	2.7	0.62
Brunei	61712	2.7	0.81
Egypt	192035	2.38	0.23
Nigeria	609893	2.38	0.45
Norway	64848	3.59	0.79

Calculate Herfindahl- Hirschman Index (HHI), Shannon Wiener Index (SWI) and Adjusted Shannon Wiener Neumann index (SWNI).

1B. A textile dryer is found to consume 4 m³/hour 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.

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Month	Diesel Consumption (lit)	Electrical Energy (KW-hr)
March, 2018	4045	14108
April, 2018	4240	14620
May, 2018	1475	5193
June, 2018	985	3325
July, 2018	280	932
Aug, 2018	170	500
Sept, 2018	220	797
Oct, 2018	1465	5217
Nov,2018	415	1454
Dec, 2018	120	367
Jan, 2019	280	983
Feb, 2019	765	2595

2A. The Diesel Generator set installed for a commercial building yielded the following data during a one year energy monitoring program.

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, 2019 is 15000 kWhr.

- **2B.** A plant which runs for 8000 hours a year has a boiler with an efficiency of 80%. The boiler produces steam at 15 kg/cm². Steam must travel via pipeline to the plant, located at some distance. The diameter of steam pipeline is 100mm and the total length of pipe from the boiler to the plant is 300m. The surface temperature of the non-insulated part of pipeline, which is 150m in length, is 195 °C. The energy manager proposes a project to properly insulate the non-insulated length of the pipeline with 70mm of glass wool with aluminum cladding, so as to reduce the surface temperature to 70 ° C. Find out the fuel and costs savings and the payback period for the project if the proposal were to be accepted. Assume fuel cost is Rs 15/kg with GCV= 14250 kCal/kg, ambient temperature of 25 °C and insulation material is available at Rs 4000 per sq. meter.
- **2C.** Explain any two energy conservation measures applicable to diesel generator systems.
- **3A.** Define Energy Auditing, as per ECA 2001. Discuss the 10 step detailed energy audit methodology prescribed by BEE.
- **3B.** With a neat diagram, briefly explain the power stages of a 3 phase Induction Motor.

A 34 kW/45 HP, 4 pole, 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 and power factor at full load if operating temperature is 120 °C.

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- **4A.** An industrial process requires a water discharge of 68 m³/hr. 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 daily throughout the year.
 - a. Compute the total power drawn by the motor, driving pump A.
 - b. Suggest the best possible recommendation to suit the flow demand. [Refer the pump characteristic curves & related data shown below]
 - c. Compute the payback period for the recommendation given. [Assume energy cost to be INR 6/- per unit]



Pump	Motor Efficiency	Cost of the Pump
В	88%	INR 60000
С	88%	INR 62000
D	86%	INR 64000
Е	85%	INR 64000

- **4B.** Explain the six-step methodology followed for a lighting audit. Hence, discuss how reduction of feeder voltage and use of occupancy sensors can help reduce the energy consumption in an office space.
- **5A.** Explain 5S management principle. How is it implemented? What are its benefits?
- **5B.** 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)**

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