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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent Institution of MAHE, Manipal )*

## VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

## MAKE-UP EXAMINATIONS, DECEMBER 2018

## SUBJECT: ENERGY AUDITING [ELE 4006]

REVISED CREDIT SYSTEM

**Time: 3 Hours** **Date: 29, December 2018** **Max. Marks: 50**

**Instructions to Candidates:**

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

**1A.** What is the aim of the Electricity Act, 2003? Explain, by clearly bringing out the significance of reforms brought by the Electricity Act, 2003 in the areas of

- Generation, Transmission & Distribution.
- Reforms in Tariff principles & the Role of CEA ***(05)***

**1B.** With a neat block diagram, explain the essential components of energy action plan. ***(05)***

**2A.** 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. ***04***

**2B.** Define the following with respect to Energy Conservation Act, 2001.

i. Energy Auditing
ii. Designated Consumer ***02***

**2C.** What is an energy efficient motor? Explain how the intrinsic losses are reduced in an energy efficiency induction motor. ***04***

**3A.** Explain the methodology followed for carrying out assessment of lighting systems employed in Industries. Also, explain how reduction in lighting feeder voltage is a tool for energy conservation? ***04***

**3B.** A centrifugal water pump operates at 36 $m^3$/hr and at 1800 RPM. The pump operating efficiency is 65% and motor efficiency is 89%. The discharge pressure gauge shows 3 $kg/cm^2$. The suction is 3 m below the pump centerline. If the speed of the pump is reduced by 20 %, estimate the following:

a) pump flow,

b) pump head

c) motor power.

Assume motor and pump efficiency remains same at the reduced speed. ***04***

**3C.** Explain any two energy conservation methods applicable to centrifugal pumps. ***02***

**4A.** A PV array of 500W has been installed to pump water from bore well of 2 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- INR 400/watt, Life span = 15 yrs
- Motor & Pump system- Rs 100/watt, Life span – 8 years
- Pipe cost- Rs 400/m; Life span – 5 yrs
- Cost of digging bore well – Rs 500/m
- Maintenance cost – Rs 3000/year
- Misc. cost: Rs 100/Watt

If interest rate is 10% and inflation is 6%, calculate Life cycle cost of the system if the project period is of 15 years. ***05***

**4B.** What is the 5S management tool? Explain in details, clearly bringing out the significance of each S, its implementation technique and potential benefits. ***05***

**5A.** Scooter Oil Mills, Brahmavar, during a monitoring program produced the following data. Derive the equation for the best fit straight line which describes the production to energy use. Calculate the Pearson's Correlation Coefficient. Perform a CUSUM analysis and comment on the energy consumption pattern.

| **Month** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** |
|---|---|---|---|---|---|---|---|---|---|
| Production (Ton/Month) | 480 | 540 | 560 | 620 | 420 | 520 | 640 | 620 | 600 |
| Energy Use (TOE/Month) | 440 | 540 | 580 | 480 | 420 | 400 | 580 | 424 | 420 |

***07***

**5B.** An energy auditor audits a 75 kW four pole 3 phase induction motor operating at 49.8 Hz and rated for 415 V, 100 A at 1440 RPM. The actual measured speed was 1470 RPM and the power analyzer recorded the applied voltage to be 428 V and drawing a current of 30 A.

a) The auditor works out the percentage loading of the induction motor as a ratio of line current drawn to the rated current of the motor. Do you agree with the above methodology adopted by the auditor? Justify your answer with reasons.
b) Determine the percentage loading of the motor for the given operating conditions. ***03***