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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent Institution of MAHE, Manipal )*

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

## END SEMESTER EXAMINATIONS, NOVEMBER 2018

## SUBJECT: ADVANCED ENERGY MANAGEMENT [ELE 4005]

REVISED CREDIT SYSTEM

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

**Instructions to Candidates:**

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

**1A.** What are the features of a smart grid? ***(02)***

**1B.** Draw a neat block diagram showing building blocks of Advanced metering infrastructure. ***(03)***

**1C.** Why Zigbee is the preferred choice for implementing the smart metering concept? List the advantages of ZigBee protocol for smart metering applications. ***(02)***

**1D.** What are the different levels of abstraction in a RDBMS environment? ***(03)***

**2A.** An electricity supply company wishes to set-up a database management system to monitor the power consumption details of its customers. Create Entity-Relationship model with appropriate notations to store the following details:

1. Customer details.

2. Various electrical loads belonging to the customer (like Fan, washing machine, air-conditioner)

3. Power consumption details of each load (like Voltage, Current, power factor) on an hourly basis.

4. Monthly bill details of the customer. ***(04)***

**2B.** Comment whether the relational model of the ER model developed in Q2A adheres to database normalization requirements, give reasons. ***(02)***

**2C.** With reference to Q2A, write relational algebra expressions

1. To display the names of customers.

2. The number appliances related to each customer. ***(02)***

**2D.** With reference to Q2A, write SQL statements

1. To insert a sample record into customer relation.

2. To display the list of electrical loads registered for any given customer. ***(02)***

**3A.** Define ACID properties as related to RDBMS? ***(02)***

**3B.** List the principles of energy management. ***(02)***

**3C.** Highlight the importance of "Energy Intensity" with respect to a nation's economy. ***(03)***

**3D.** An industry is having contract demand of 1200 kVA. The minimum billing demand is 85% of the contract demand. The connected load of the plant is 2100 kVA. The recorded demand and power factor for the month of March 2018 is 1400 kVA and 0.74. The monthly consumption is 2.5 lakh units. The average load and maximum load of the industry is 750 kW and 1000 kW respectively. Calculate

1. Minimum billing demand of the industry 2. Load factor of the plant

3. Demand factor of the plant ***(03)***

**4A.** An industrial plant has an incandescent lighting load of comprising 120 Nos. of 60 W and 150 Nos. of 100 W. Calculate the energy savings if each incandescent load is replaced by 1 X 40W fluorescent load. Lighting is required for 6000 hours/year and the cost of electricity is Rs. 5.6 per kWh. Replacement cost is Rs. 175 per unit consider ballast consumption as 12 W

Given data:

100 W incandescent lamp = 2200 lumens

60 W incandescent lamp = 1320 lumens

40 W Fluorescent lamp = 2400 lumens ***(02)***

**4B.** Explain with relevant phasor diagrams the methods of power factor improvement using shunt capacitors and synchronous condensers. ***(03)***

**4C.** What is block rate tariff? What are its advantages and disadvantages? ***(02)***

**4D.** A consumer requires an induction motor of 50HP. He can choose between the following motors:

Motor A: Efficiency 83%; Power factor = 0.92,

Motor B: Efficiency 92%; Power factor = 0.83.

The consumer is charged on a two-part tariff of Rs 74 per KVA of maximum demand plus 5paise per unit. The power factor of the motor B is improved to 0.92 by installing condensers. The motor B is cheaper by Rs 200 than motor A. The cost of condenser is Rs 65 per KVAR. Find which motor is economical and by how much, assume 10% rate of interest and depreciation, if the motors work round the clock annually (8760 hours). ***(03)***

**5A.** Two steam turbines each of 30MW capacity take a load of 45MW together. The fuel consumption rate in kg/hr for both turbines are given by the following equations:

$S_1 = 2400+12\ P_1 -0.00012\ P_1^2$ ; $S_2 = 1200+8.4\ P_2 -0.00006\ P_2^2$;

P represents the load in KW and S represents fuel consumption rate per hour. Find the most economical loading. ***(03)***

**5B.** Explain the need for assessing the performance of HVAC systems. ***(02)***

**5C.** With the help of relevant sketches illustrate how variable speed drives achieve energy efficiency while driving a fan load. ***(03)***

**5D.** A certain investment in a solar power plant project yields an annual return of Rs 11,000 at a discount rate of 12%. If the project ends after 10 years, what is the amount that must be invested at the beginning of the project? ***(02)***