Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

ONLINE EXAMINATIONS, JANUARY- FEBRAURY 2021

ADVANCED ENERGY MANAGEMENT [ELE 4005]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 01 February 2021** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- All necessary steps must be clearly shown for numerical.

1A. Define the terms "Energy Intensity" and "Gross Domestic product" (GDP). What is the interrelationship between them? What factors decide GDP of a country? ***(03)***

1B. List the "Designated consumers" (DCs) notified under the Energy Conservation Act of 2001. What are the requirements need to be complied by the DCs? ***(03)***

1C. A paper mill invests Rs 2 lakhs on an energy saving measure. Every year during the project period, this initiative saves 7000 units in energy and Rs 4,700 as demand charges. The annual maintenance cost incurred by the mill per year is Rs 10,000. If life of the project is 6 years, calculate the "Net Present Value" for the investment and comment on the feasibility of the project. Assume an energy cost of Rs 5 per unit during the project duration. The discount rate during the project period is 11%. Show all necessary steps clearly. ***(04)***

2A. With the help of a neat sketches, show the areas illuminated by daylight under vertical fenestration. ***(03)***

2B. A 3-Phase, 415V, 80KW Induction motor is operating at 50KW at a 0.707 power factor. What is the KVAR rating of the capacitors required to improve the power factor to 0.96? Also estimate the reduction KVA and the current drawn by improving the power factor. ***(03)***

2C. "Energy monitoring requires quantitative information", justify this statement with a suitable real-world example.

Energy consumption and production data were collected for a steel plant over a period of one year. During end of June, a heat recovery system was installed. Using CUSUM technique, estimate the energy savings in terms of ton of oil equivalent (toe) and the reduction in specific energy consumption achieved with the installation of waste heat recovery system. ***(02) + (02)***

Month	Energy consumed (toe)	Production (ton)
Jan	635	772
Feb	705	972
Mar	650	802
Apr	643	842
May	560	622
Jun	555	682
July	605	772
Aug	620	832
Sep	685	952
Oct	597	762
Nov	527	622
Dec	555	682

3A. What are the factors that decide the cost of generated and purchased electricity? ***(03)***

3B. What are typical causes for waste in an organization? With a neat sketch show the classification of "Waste Minimization" techniques. ***(03)***

3C. A generating station has the following daily load cycle:

Time (hours)	0 - 6	06 - 10	10 - 12	12 -16	16 - 20	20 - 24
Load (MW)	125	310	350	130	440	205

Find (i) maximum demand (ii) units (KWH) generated per day

(iii) average load (iv) load factor. ***(04)***

4A. What is the purpose of a performance test on a boiler? With a neat sketch explain the direct method of testing a boiler. ***(03)***

4B. The measured values of a 20 TR package air conditioning plant are given below:

Average air velocity across suction side filter: 2.5 m/s

Cross Sectional area of suction: 1.25 m^2

Inlet air = Dry Bulb:20^oC, Wet Bulb:14^oC, Enthalpy: 9.37 kcal/kg

Outlet air=Dry Bulb:12.7^oC, Wet Bulb: 11.3^oC; Enthalpy: 7.45 kcal/kg

Specific volume of air: 0.85 m^3/kg,

Power drawn: by compressor: 10.69 kW, by Pump: 4.86 kW, by Cooling tower fan: 0.87 kW.

Calculate the airflow, cooling effect, specific and overall power consumption, and energy efficiency ratio.

(03)

4C. A textile mill intends to collect data from the induction motors installed in its premises. The mill intends to collect the following data:

1. Voltage across the machine.
2. Current drawn by the machine.
3. Power consumed by the machine.

With usual notations, develop an Entity-relationship (ER) model to depict the above scenario. ***(04)***

5A. For the ER model developed in **Q4C**, write relational algebraic expressions for the following:

1. List the name plate parameters of all the motors.
2. List the only the rated speed of all the motors.
3. List voltage, current and power consumed by a given motor. ***(03)***

5B. Explain the concept of database normalization making use scenario depicted in **Q4C**. ***(03)***

5C. Highlight some important features that make ZIGBEE protocol ideal for metering applications. Also explain the device types and operating modes with reference to ZIGBEE. ***(04)***