Seat No. | | | | | | |

* 2 2 2 6 *

मठ - 069

ELECTIVE - I

Energy Conservation & Management

(New) (1251)

P. Pages : 4

Time : Three Hours **Max. Marks : 100**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **any two** questions from each unit.
5. Neat diagram must be drawn wherever necessary.
6. Assume suitable data if necessary.

UNIT - I

1. a) Explain importance of specific energy consumption with example. **5**

b) A pump consumes 100 kw power using a standard squirrel cage induction motor. Energy auditor suggest to replace this motor with E.E. motor which will save 3% of power cost of EE motor is Rs. 2,50,000/- and resell cost of existing motor is Rs. 50,000/- Payback up to 2 years is acceptable to the organisation. Give your recommendation pump operates for 6000 hrs in a year & power cost is Rs. 8/- per kwh. **5**

2. Explain step by step approach for maximum demand control. **10**

3. c) Following data is obtained from analysis of a boiler performance.
Heat losses through fluegases (after last heat exchanger) 8%
Heat recovery by economiser - 2.5%
Heat recovery by air preheater - 2%
Heat losses due to moisture present in the air - 1%
Heat losses due to moisture present in fuel - 2%
Heat losses due to water evaporation due to H_2 in fuel - 3%
Losses due to radiation & heat unaccounted - 1%
Draw a sankey diagram from above data. **5**

मठ - 069

d) Compare & recommend on the basis of life cycle cost.

	Compressor X	Compressor Y
Power consumption	160 kw	155 kw
Life of compressor	15 years	12 years
Cost of compressor	19 lakh	26 lakhs

Cost of power is at Rs. 9 per kwh and operating hours for the compressor are 5500 hrs/year. **5**

UNIT - II

4. Refer following data for power bill of sustainable corporation limited. Contract demand : 450 kVA M.D. - 510 kVA. Fixed charges are Rs. 300/- per kVA, Penalty for excess demand is at Rs. 200/- per kVA. Basic rate of energy is Rs. 8/- per kwh. Existing P.F. is 0.78. Penalty / incentive for power factor is at rate of 1% per % of variation from power factor of 90% Penalty / incentive to be calculated on fixed plus energy cost.

	Units in kwh	% penalty / incentive
A zone	42000	– 10%
B zone	85000	10%
C zone	55000	0%
D zone	90000	20%

Compute average rate of power the organization is paying. Make suggestion on how the energy bill can be reduced.
If power factor is improved from 0.78 to 0.99 by adding capacitors then compute new rate of power. When power factor is improved to 0.99 M.D. comes down to 430 kVA. **10**

5. e) For a factory average P.F. is 0.72 and average load is 350 kw. Calculate capacitor required to improve P.F. to 0.98. Cost of capacitor is Rs. 500 per kVAR & bill reduction because of capacitor intallation will be Rs. 73,000/- per month. Calculate payback period. **5**

f) Define each terminology in one line : system, experiment, model, simulation & modelling. **5**

6. Describe ten step methodology of energy auditing. **10**

UNIT - III

7. Calculate motor efficiency and P.F. at full load with following data : **10**
Rated power - 60 kw
Voltage - 415 V
Current - 105 A
Speed - 1445 RPM
Connection - Delta
No laod test data
Voltage - 415 V
Current - 20A
Frequency - 50 Hz
Stator phase resistance at 20°C – 0.17 Ω
No load power - 1650 watts
Temp at full load of motor = 110°C

8. A boiler uses F.O. as fuel with G.C.V. of 10200 kcal kg determine boiler η by indirect method based on GCV ultimate chemical analysis by % wt is carbon - 84, Hydrogen - 13, Oxygen - 1.0, Sulphur - 1.0. Dry flue gas analysis show 10.5% of oxygen by volume. Flue gas temp. 210°C & ambient temp. is 20°C. Moisture in air 0.025 kg/kg of air.
Take radiation & unaccounted losses at 1% **10**

9. f) Explain importance of 'Illumination Efficiency' and 'Color rendering index'. **5**

g) Calculate boiler η by direct method.
Boiler capacity - 20 TPH laoding - 80%
Fuel consumption - 1400 lit per hours (LDO)
Steam enthalpy - 640 kcal/kg
Inlet water temp. - 60°C
Density of fuel (LDO) - 0.82 kg/lit
C.V. of fuel (LDO) - 10200 kcal/kg **5**

UNIT - IV

10. h) State affinity laws for centrifugal pumps. Show effect of speed on performance curve. **5**

i) From given data calculate power lost in % & in cum/year,
Also calculate energy lost per year & financial loss per year.
ON time - 45 second OFF time 175 seconds
compressor capacity - 400 cum/min
cut in pressure - 7 kg/cm^2. Cutout pressure 7.4 kg/cm^2
power consumed on load 125 kw
Power consumed on no-load - 38 kw
cost of power - Rs. 8 per kwh
operating hours - 4000 hrs/year. **5**

11. j) Pump up test was carried out for a compressor calculate compressor capacity in cum/min from the given data recorded during the test.
Design capacity of compressor was 50 cum/min, comment on performance of the compressor.
Data :

Initial pressure - 0.5 kg/cm^2

final pressure - 9 kg/cm^2

Atm. Pressure - P_0 1.026 kg/cm^2

Pump up time - 265 sec.
Volume of receiver 12 cum
volume of pipe till main valve - 2 cum **5**

k) Only sketch topping & bottoming cycles of co-generation system. **5**

12. l) Explain how system η can be increased in a co-generation system. **5**

m) Brief minimum 10 ENCON measures in Air conditioning system. **5**

UNIT - V

13. Explain five major steps involved in using 'Force Field Analysis' and show a typical force field analysis chart. **10**

14. Explain 'Role & Responsibilities' of Energy Manager. **10**

15. Write short notes on : **10**

n) Top Management support.

o) Information system with ref. to energy action planning.

****