PARUL INSTITUTE OF ENGINEERING & TECHNOLOGY
MECHANICAL ENGINEERING DEPARTMENT
PO Limda, Tal. Waghodia, Vadodara – 391 760

Energy Conservation and Management (171907)

Department Elective - I

Semester / Year : _Seven / _Four_ **Batch : _I__**

Name of Faculty : _____Academic Year:_____ **T / P : _T_**

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In-Charge Head of the Department

Unit 1: Energy Scenario

Q.1 Explain long term energy scenario for India.

Q.2 Write short note on energy security and energy intensity.

Q.3 Define energy conservation with suitable example

Q.4 Explain need of energy sector reforms in India.

Q.5 Discuss in brief Energy conservation Act 2001 and its features.

Q.6 Write note on 'Indian Energy scenario'.

Q.7 Explain in brief the following:

(i) Renewable and non-renewable energy.

(ii) Commercial and Non-commercial energy

(iii) Low grade and High grade energy

(iv) primary and secondary energy

Q.8 How Bureau of Energy Efficiency (BEE) facilitates energy efficiency programs in India?

Q.9 How does an industry, nation and globe would benefit from energy efficiency programs?

Q.10 Explain Demand Side Management(DSM)

Q.11 Briefly explain energy efficient equipment.

Q.12 Explain energy strategy for the future

Q.13 Explain sector wise energy consumption

Q.14 Explain energy pricing

Q.15 briefly explain importance of energy conservation

Q.16 List four important duties of energy manager in industry as per energy conservation act-2001.

Unit 2: Energy Basics and Its Various Form and Conservation

Q.1 Define the following terms:

(a) Power factor (b) Load factor (c) Relative humidity (d) dew point temperature

(e) Calorific value (f) latent heat of vaporization (g) sensible heat (h) temperature

(i) Pressure (j) heat capacity (k) specific heat (l) Latent heat of fusion (m) Specific gravity of fuel

Q.2 what are the three modes of heat transfer? Explain with examples?

Q.3 Explain why steam is used commonly in industries? **OR** "Steam has been popular mode of conveying energy, since the industrial revolution" justify it

Q.4 Define energy and explain various form energy

Q.5 explain energy conversion with suitable example

Q.6 what is 'contract demand' and 'maximum demand'? How is maximum demand recorded?

Q.7 Explain the following

(i) Reactive power and active power

(ii) Importance of time of day (TOD) tariff

Q.8 state and explain the factors that influence thermal performance of the buildings.

Q.9 Give various electricity saving techniques. **OR** Discuss electricity saving techniques by category of end use.

Q.10 Explain general procedure for cooling load calculation.

Q.11 Explain how power factor improvement helps to save energy.

Q.12 A portable machine requires a force of 250 N to move it. How much work is done if the machine is moved 25 m and what average power is utilized if the movement takes 50s?

Q.13 A three phase induction 75 kW motor operates at 55 kW. The measured

Voltage is 415 V, Current 80 A. Calculate the power factor of the motor.

Q.14 The energy consumption of a industry per month is 2,50,000 units. The contract demand of a plant is 1200 kVA. The minimum billing demand is 75% of the contract demand. The basic tariff structure is as follows :

Demand Rate : 0-500 kVA = Rs. 200/kVA

501-1000 kVA = Rs. 180/kVA

Excess over 1000 kVA = Rs. 150/kVA

Energy Rate : Rs. 5.00 for the first one lakh units/ month

Rs. 4.50 above one lakh units/month

Fuel Surcharge : Rs. 0.20 per unit/month

Service Tax : Rs. 0.30 per units/month

Meter rent : Rs. 250/month

Calculate the cost of monthly electricity consumption.

Q.15 A three phase 415V, 100KW induction motor is drawing 55 kw at a 0.75 PF. Calculate the capacitor rating requirement at motor terminals for improving PF to 0.9 Also Calculate the reduction in current drawn and kvA reduction from the point of installation back to generated side due the improved P.F

Q.16 A three phase,10 kW motor has the name plate details as 415 V, 18.2 amps and 0.9 PF. Actual input measurement shows 415 V, 12 amps and 0.7 PF which was measured with power analyzer during motor running. find motor loading %

Q.17 A fluorescent tube light consumes 40 W for the tube and 10 W for choke. If the lamp operates for 8 hours a day for 300 days in a year, calculate the total energy cost per annum if the energy cost is Rs.3/- per kWh

Unit 3: Energy Management & Audit

Q.1 Define Energy management. State the basic principles and benefits of energy management.

Q.2 what is the role Energy Management?

Q.3 what is energy management? How it helps in solving problems of energy crisis?

Q.4 Define energy audit as per the energy conservation act- 2001.

Q.5 what do you mean by 'Energy audit'? Discuss types of energy audit briefly.

Q.6 what is the importance of Energy Audit?

Q.7 Layout general procedure in Energy Audit. **OR** Discuss various steps of energy audit.

Q.8 Classify the energy audit & explain the three phases of detailed energy audit.

Q.9 why instruments are require for energy audit.

Q.10 Give name and use of different energy audit instruments.

Q.11 Define and explain following terms

(i) Plant energy performance (ii) Production factor

(iii) Reference year equivalent energy use

Q.12 Electricity saving technique by category of end use.

Q.13 write short note on Bench marking

Q.14 explain in brief matching energy use to requirement

Unit 4: Financial Management

Q.1 Name various financing options. Explain self-Financing energy management

Q.2 Discuss the role of energy service companies (ESCOs)

Q.3 Explain Internal rate of return technique with example.

Q.4 Explain Simple pay back method with its advantage & limitation.

Q.5 Explain Sensitivity Analysis & List the micro & macro factors.

Q.6 explain net present value method of financial analysis

Q.7 describe the procedure for selecting the finance option

Q.8 A co-generation plant installation is expected to reduce a company's annual energy bill by Rs.24 lakhs. If the capital cost of the new cogeneration installation is Rs.90 lakhs and the annual maintenance and operating costs are Rs. 6 lakhs, What will be the expected pay back period for the project?

Q.9 Using the net present value method, evaluate the financial merits of two proposed projects shown in table. The annual rate is 8 % for each project.

	Project1	Project2
Capital cost	30000	30000
Year	Net annual Saving(Rs)	Net annual Saving(Rs)
1	+6600	+6000
2	+6600	+6000
3	+6300	+6000
4	+6300	+6000
5	+6000	+6000
6	+6000	+6000
7	+5700	+6000
8	+5700	+6000
9	+5400	+6000
10	+5400	+6000
Total net saving at end of tenth year	+60000	+60000

Q.10 calculate Simple payback period for a continuous Deodorizer that costs Rs.60 lakhs to purchase and install, Rs.1.5 lakhs per year on an average to operate and maintain and is expected to save Rs. 20 lakhs by reducing steam consumption (as compared to batch deodorizers)

Q.11 Cost of an heat exchanger is Rs.1.00 lakhs .Calculate simple pay back period considering annual saving potential of Rs.60,000/- and annual operating cost of Rs.15,000/-

Q.12 Calculate simple pay back period for a boiler that cost Rs.75.00 lakhs to purchase and Rs.5 lakhs per year on an average to operate and maintain and is expected to annually save Rs.30 lakhs.

Q.13 Investment for an energy proposal is Rs.10.00 lakhs. Annual savings for the first three years is 150,000, 200,000 & 300,000. Considering cost of capital as 10%, what is the net present value of the proposal?

Q.14 Calculate the internal rate of return for a economizer that will cost Rs.500,000, will last 10 years, and will result in fuel savings of Rs.150,000 each year.

Q.15 an energy auditor recommended to replace an old air fan and incompetency designed air delivery duct system causing Rs. 20 Lakh a year in electricity cost by changing the system with modern backward curved fan with adequately designed duct system for total investment costs of Rs. 2 Lakh Expected electricity cost reduction is 5% considering over 15 years sustained saving calculate IRR

Unit 5: Energy Monitoring and Targeting

Q.1 Explain how CUSUM chart is drawn with an example.

Q.2 what are the steps involved in CUSUM analysis?

Q.3 List the elements of monitoring & targeting system with its functions.

Q.4 State key elements of Energy monitoring and targeting system. Also discuss its benefits.

Q.5 what is the difference between monitoring and targeting?

Q.6 write short note on energy management information system

Q.7 the following sample data are produced during monitoring program. Establish energy- production relationship for the given foundry case, also plot the energy-production graph for nine months.

Month	Production Ton./month	Energy Toe/month
1	320	300
2	520	400
3	240	280
4	620	424
5	600	420
6	380	340
7	440	340
8	460	380
9	520	380

Unit 6: Energy Efficiency in Thermal Utilities and systems

Q.1 Give energy efficiency measures in boilers.

Q.2 Write step wise procedure to calculate Boiler efficiency.

Q.3 Prepare a list of five measures for energy optimization in boilers and in lighting systems.

Q.4 Classify the different types of steam traps with their principle.

Q.5 State & explain energy efficiency measures for industrial furnace

Q.6 List the various types of heat losses in furnace..

Q.7 Give tips for energy saving in pumps

Q.8 Give tips for energy saving in compressors.

Q.9 List the seven important suggestions for energy saving in pumps & fans.

Q.10 List the suggestions for improving the efficiency in compressed air system.

Q.11 List the energy saving opportunities in refrigeration Air-conditioning plant area.

Q.12 The following are the data collected for boiler using furnace oil as a fuel. Carbon content in fuel =84% Hydrogen content in fuel =12% Moisture content in fuel =0.5% GCV of fuel = 10000 kCal/kg Surface temperature of boiler = 80 0C Humidity in ambient air = 0.025 kg/kg of dry air Mass of dry flue gases =21.36 kg/kg of oil Actual mass of air supplied/kg of fuel = 21.49 kg/kg of fuel Flue gas temperature =190^{0}C Ambient air temperature = 30^{0}C Specific heat of flue gases = 0.23 kCal/kg^{0}C Specific heat of super heated steam in 0.45 kCal/kg^{0}C Radiation & convection losses = 0.38% Losses due to incomplete combustion= 0.01%. Find out the boiler efficiency by indirect method.

Q.13 Calculate ILER value & annual energy wastage for the following. Floor area of the interior room = (9 X 5) Meter^2. Mounting Height = 2 meter Total circuit watts of the installation by power meter = 990 W Average maintained illuminance =700 lux As per the color rendering index table ,Target load efficiency = 46 lux/W/m2 No. of

operating hrs/day =8 No. of operating days/annum =300. Give comment on your answer.

Q.14 An oil-fired reheating furnace has an operating temperature of around 1340^{o}C. Average fuel consumption is 400 litres/hour. The flue gas exit temperature after air preheater is 750 ^{o}C. Air is preheated from ambient temperature of 40 ^{o}C to 190 ^{o}C through an air pre-heater. The furnace has 460 mm thick wall (x) on the billet extraction outlet side, which is 1 m high (D) and 1 m wide. The other data are as given below. Find out the efficiency of the furnace by both indirect and direct method.

Q.15 In a heat exchanger the hot stream enters at 70^{O}C and leaves at 55^{O}C. On the other side the cold stream enters at 30^{O}C and leaves at 55^{O}C. Find out the LMTD of the heat exchanger.

Q.16 A shell and tube exchanger of following configuration is considered being used for Condensing turbine exhaust steam with cooling water at the tube side. **Tube Side** 20648 Nos x 25.4mmOD x 1.22mm thk x 18300mm long Pitch – 31.75mm 60o triangular 1 Pass The monitored parameters are as below:

Parameters	**Units**	**Inlet**	**Outlet**
Hot fluid flow, W	kg/h	939888	939888
Cold fluid flow, w	kg/h	55584000	55584000
Hot fluid Temp, T	^{O}C	No data	34.9
Cold fluid Temp, t	^{O}C	18	27
Hot fluid Pressure, P	Bar g	52.3 mbar	48.3
Cold fluid Pressure, p	Bar g	4	3.6

Q.17 In a brewery chilling system, ethylene glycol is used a secondary refrigerant. The designed capacity is 40 TR. A test was conducted to find out the operating capacity and energy performance ratios. The flow was measured by switching off the secondary pump and measuring the tank level difference in hot well. **Measurements data**: Temperature of ethylene glycol entering evaporator = (-) 1^{o}C Temperature of ethylene glycol leaving evaporator = (-) 4 ^{o}C Ethylene glycol flow rates = 13200 kg/hr Evaporator ethylene glycol pressure drop (inlet to outlet) = 0.7 kg/cm^{2} Power input to compressor electrical power, kW = 39.5 kW Specific heat capacity of ethylene glycol = 2.34 kCal/kg^{o}C

Unit 7:Heat Recovery and Cogeneration

Q.1 what do you mean by co-generation? Classify co-generation system & explain bottoming cycle

Q.2 what are the advantages of co-generation power plant?

Q.3 Discuss the sources of waste heat and its potential applications.

Q.4 With a neat sketch explain Gas turbine co-generation plant

Q.5 Explain the difference between bottoming and topping cycle co-generation plants.