

# College of Engineering, Pune

## (Final Year B. Tech)- (Mechanical)

(Subject Code)- ME 406 (Energy Conservation and Management)

Date- 29 November 2012

Timing: 3 hrs

Academic Year: 2012- 13

Max. Marks: 50

### End semester Examination

Instructions:

1. Attempt all question
2. Figures to the right indicate full marks
3. Use of non-programmable calculator is permitted
4. Make suitable assumptions if necessary

Q. 1	A.	<p>A certain process industry has machines and appliances. Table 1 shows list of machines and appliances, their rating, number of hours of operation and percentage loading.</p> <p>i. Draw a load curve of the Industry on single day basis? 3</p> <p>ii. What is connected load? 1</p> <p>iii. What is monthly electricity bill of the industry? (Refer tariff given in Table 2) 2</p> <p>iv. What is the diversity factor on the connected load? 1</p> <p>v. Determine the capacity of single transformer to be selected? [Take current power factor for connected load - 0.9] 1</p> <p>vi. If the Industry has to maintain a power factor of 0.95. How many capacitors of 100VAR must be installed to achieve this target? 2</p>	
Q.2		<p>Table 3 shows observations of leakage test conducted on a double-acting reciprocating compressor installed in a paint shop. The compressor data is as follows</p> <p>Voltage: 410, V</p>	

Current: 28 A,  
 Power Factor 0.91  
 Discharge Pressure: 15 bar,  
 Barometer – 720 mm  
 Paint shop Ambient temp. – 36°C  
 RPM - 1200  
 FAD: 50 cfm  
 Daily operation: 14 hrs.  
 Estimate

Time in hrs.	Compressor Status
0800	ON
0815	OFF
0827	ON
0835	OFF
0840	ON
0853	OFF
0900	ON
0908	OFF
0920	ON
0928	OFF
0938	ON

- i) Compressor Efficiency 2
- ii) Quantity of leakage in cfm. 2
- iii) Monetary loss in leakage per day if electricity tariff is Rs. 8 per kWh 2
- iv) Volumetric Efficiency of the compressor if cylinder diameter is 100 mm and stroke 120mm 2
- v) If the compressor is shifted from paint shop to the adjacent shade where ambient temperature is 30°C. What will be reduction in daily electricity consumption of the compressor at the same compressor efficiency determined above? What will be corresponding volumetric efficiency? 2

Q. 3	A	Discuss some good practices in lighting.	3
	B	With the help of system curves describe different methods of discharge control in centrifugal pumps from energy conservation point of view.	4
	C	Explain losses in transformers	3
Q.4	A	If Simple Payback Period (SPP) of certain process equipment is 1.5 years. What is internal rate of return (IRR) if operating life of the equipment is 2 years and salvage value and maintenance costs	3

		are zero?	
	B	<p>Capital cost of a shell tube heat exchanger is Rs. 8 lakhs and life 5 years. The discount rate for the company is 18%. By installing this heat exchanger, the cash flow predicted in each year is Rs. 3.3 Lakhs. The annual maintenance cost is Rs. 50,000/-.</p> <p>Determine</p> <ul style="list-style-type: none"> <li>i) Simple Payback period and</li> <li>ii) Return on Investment</li> <li>iii) To break even the capital investment at what cost the heat exchanger must be sold at the end of 5 years?</li> <li>iv) The profitability Index</li> <li>iv) Annualized Life Cycle Cost</li> </ul> <p>when <math>CRF = d(1+d)^n / [(1+d)^n - 1]</math></p>	<p>1</p> <p>1</p> <p>2</p> <p>2</p> <p>1</p>
Q5.	A	Discuss with examples types of insulations used in the industrial applications	4
	B	The daily out put of paper from a paper-manufacturing machine is 250 tonnes per day (TPD). The raw material for the paper is called the paper stock. The completely dry paper stock is mixed with water before feeding into the machine. The total solid contents of the mixture at the entry of the machine are 25%. The total solid contents of the finished paper are 95% at the exit. 75% percent of water removed from the paper is treated and recycled. To meet the daily target of production, how many water tankers of 8000 liters capacity are daily required for the machine?	3
	C	Define Energy Audit. Explain Types of Energy Audits?	3

Table 1. Percentage load on the appliances

Sr. No.	Appliance/s and Rating, kW	Time, Hrs. 00 to 0300	0300 to 0600	0600 to 0900	0900 to 1200	1200 to 1500	1500 to 1800	1800 to 2100	2100 to 2400
1	Total Fan and Lighting in the Premises, 5 kW	20%	20%	40%	100%	100%	100%	100%	20%
2	Central Compressor Facility, 15kW	50%	50%	75%	100%	75%	100%	100%	50%
3	Metal Presses, 20kW (Total)	0%	0%	50%	100%	100%	100%	100%	100%
4	Material Handling cranes, 20kW (Total)	0%	0%	0%	0%	100%	100%	100%	0%
5	Heating and drying ovens, 15kW(Total)	100%	100%	100%	100%	0%	0%	100%	100%

Table 2. Slabs for Monthly Electricity tariff

Consumption, kW	Tariff, Rs./kWh
Up to 1000	6
Above 1000 and up to 5000	7
Above 5000 and up to 10000	9
Above 10000	12