1.ENERGY EFFICIENCY FUNDAMENTALS

Question 1 (Weight 10%)

When making efficiency improvements, passive and active efficiency measures should always be followed by which of the following in order to sustain savings?

( )Environmental goals
( )Recycling
( )Prioritizing efficiency projects
(x)Monitoring ← Correct answer

Question 2 (Weight 10%)

Installing occupancy and light-level sensors and implementing variable frequency drives in motors are examples of which type of efficiency measure?

(x)Active ← Correct answer
( )Passive
( )Subjective
( )Wasteful

Question 3 (Weight 10%)

Which of the following is the name for an analysis of a building's energy use where opportunities for reducing energy consumption are identified and prioritized?

( )Industrial assessment
(x)Energy audit ← Correct answer
( )Energy action plan
( )None of the above

Question 4 (Weight 10%)

How much energy efficiency improvement can be achieved with current technologies?

( )Up to 5%

(x)Up to 30% ← Correct answer

( )Exactly 70%

( )100%

Question 5 (Weight 10%)

Replacing existing equipment with lower consumption devices, fixing leaks and adding insulation are examples of which type of efficiency measure?

( )Active

(x)Passive ← Correct answer

( )Subjective

( )Wasteful

Question 6 (Weight 10%)

Why is energy efficiency at the point of use the quickest, cleanest, most effective solution to the energy dilemma?

(x)Because due to transmission and generation losses, 300 units of primary energy are required to provide 100 units of end-user electricity. Hence saving energy at the point of use is more effective than building a new power plant with double the efficiency ← Wrong answer

( )Because the cleanest unit of energy is a unit of energy that wasn't produced and used

( )Because energy efficiency solutions are available now

( )Because energy projects are low risk and outperform many other investments

( )All of the above

Question 7 (Weight 10%)

Energy efficiency can be defined as:

( )Reducing the amount of energy used by decreasing outcomes: doing less with less

( )Reducing the carbon footprint by using fewer fossil fuels

(x)Reducing the amount of energy used while maintaining outcomes: doing more with less ← Correct answer

Question 8 (Weight 10%)

What is the energy dilemma?

( )Fossil energy sources are running out but unconventional gas and oil sources are still too expensive

(x)Energy demand is forecast to double, while emissions have to be cut by half to avoid dramatic climate change ← Correct answer

( )Choosing between wind and solar power

( )Biofuels are a solution to growing energy demand but there are complaints of impact on food supplied

Question 9 (Weight 10%)

What percentage of energy consumption is used by industry, residences and tertiary buildings?

( )18%

( )30%

(x)72% ← Correct answer

( )90%

Question 10 (Weight 10%)

"You can't manage what you don't measure". Which of the following helps you overcome this issue regarding energy?

(x)Energy management software ← Correct answer

( )Energy efficient light bulbs

( )Automation systems
( )None of the above
2.ENERGY AUDITS

Question 1 (Weight 10%) Unit "Course Assessment"

What are the four steps of an audit?
(x)Kick-off; On-site inspection; Data analysis; Results restitution
( )Initial meet and greet; site analysis; Projected timeline for completion; Deficiency identification; Results restitution
( )Kick-off; Analyzing head-count; Projecting savings; On-site inspection
( )Planning; Preparation; Prioritization; Pay-off

Question 2 (Weight 10%) Unit "Course Assessment"

What are the three things an energy audit will tell you?
( )Projected energy consumption; projected priorities; potential to save energy
( )Current cash flow; projected cash flow; projected financing costs
( )Current energy consumption; projected cash flow; help with prioritizing actions
(x)Current energy consumption; potential to save energy; help with prioritizing actions

Question 3 (Weight 10%) Unit "Course Assessment"

If you wanted to obtain a detailed evaluation of the energy saving opportunities at your site, which audit would you choose?
(x)Comprehensive
( )Walkthrough
( )Investment grade audit
( )Financial audit

Question 4 (Weight 10%) Unit "Course Assessment"

Which of the following would be covered in a typical energy audit?
( )Pumping, Ventilation, Lighting, Compressed Air
( )Steam, Refrigeration, HVAC, Vacuum, Process Machinery
( )Controls, Operations, Maintenance, Employee Awareness
(x)All of the above
( )None of the above

Question 5 (Weight 10%) Unit "Course Assessment"

What are the two areas to focus on when preparing for an energy audit?
( )Access to the audit instruments
( )Commonly required data
( )Planning the audit activities to include participation of the necessary people from the facility
( )A and B
(x)B and C

Question 6 (Weight 10%) Unit "Course Assessment"

How does the facility operating profile help the auditor?
( )Shows the budget available for investment in energy efficiency programs to help the auditor tailor the report
(x)Shows the days and times that the plant is operating to help the auditor understand usage patterns and analyze rate options
( )Shows the availability of operators and technicians for interviews during the audit
( )All of the above

Question 7 (Weight 10%) Unit "Course Assessment"

Every audit will culminate with an audit report. What should be included in an audit report?

( )Executive Summary; Energy Cost Projections; Energy Management Priorities; Energy Action Plan Results
(x)Executive Summary; Energy Cost Analysis; Energy Management Recommendations; Energy Action Plan
( )Executive Summary; Audit Effectiveness Analysis; Energy Management Priorities; Energy Action Plan Results
( )None of the above

Question 8 (Weight 10%) Unit "Course Assessment"

An “Action Plan” will provide ways to manage and control power consumption and costs, as well as propose energy savings solutions.
(x)True
( )False

Question 9 (Weight 10%) Unit

What are the four activities the auditor performs?
(x)Understanding the site and gathering the data; Measuring/Monitoring/Testing; Assessing the situation, and Proposing an action plan
( )Understanding the site and gathering the data; Documenting waste; Data analysis; Testing the water for wastefulness
( )Assessing the situation; Measuring; Monitoring/Testing; preparing audit report for the client
( )Conducting a walkthrough; Employing questionnaires; Documenting and assessing; Proposing an action plan

Question 10 (Weight 10%) Unit

Follow-up actions are necessary to benefit from the audits and drive continuous improvements for the site. Which of the following are follow-up actions to an audit?

( )Review the energy action plan; Establish an implementation schedule; Measure the energy saving goals; Approve the action plan; Compare audit performance over time; Seek additional opportunities to include valued people
( )Validate the energy action plan and the implementation schedule; Measure the energy saving goals; Approve the action plan; Measure the audit goals; Set a baseline and compare the performance over time; Seek additional audit opportunities
(x)Validate the energy action plan and the implementation schedule; Define the energy saving goals; Implement the action plan; Establish indicators for measuring the fulfillment of the goals; Set a baseline and compare the performance over time; Seek additional opportunities for continuous improvement
( )None of the above

3.ENERGY RATE STRUCTURES PART 1: CONCEPTS AND UNIT PRICING

Question 1 (Weight 10%)

If a 50 kW motor runs for 4 hours what would the demand be?

( )12.5 kW
(x)50 kW ← Correct answer
( )200 kW
( )400 kW

Question 2 (Weight 10%)

If a 150 kW motor runs for 0.5 hours what would the consumption be?

(x)75 kWh ← Correct answer
( )150 kWh

( )300 kWh
( )Not enough information is given to answer

Question 3 (Weight 10%)

The simplest form of energy pricing is the Block Rate where a customer pays a single price per unit for all energy consumed during the month.
( )True
(x)False ← Correct answer

Question 4 (Weight 10%)

When prices vary based on the time of year it is called which of the following?

(x)Seasonal rates ← Correct answer
( )Time-of-use rates
( ) Real time pricing
( )None of the above

Question 5 (Weight 10%)

A facility consumed 50,000 cubic meters of gas during a 30 day billing period.
The rate structure uses the following block sizes defined in cubic meters per day:
The first 100 cubic meters per day are charged at 18 cents per cubic meter
The next 300 cubic meters per day are charged at 14 cents per cubic meter
The next 600 cubic meters per day are charged at 10 cents per cubic meter
The next 1,500 cubic meters per day are charged at 7.5 cents per cubic meter
All remaining volume is charged at 3.5 cents per cubic meter
What will the energy charge be for this billing period?
( ) $1,895.00
(x)$5,100.00 ← Correct answer
( )$18,600.00

( ) $510,000.00
( )None of the above

Question 6 (Weight 10%)

A facility incurred a peak demand of 600 kW. The site consumed 250,000 kWh during a 30 day billing period.
The first 300 kWh per kW of peak demand are charged at 6.5 cents per kWh
All remaining kWh are charged at 3.8 cents per kWh
Calculate the energy charge.

( )€6,840.00
( )€9,508.10
(x)€14,360.00 ← Correct answer
( )€1,436,000.00
( )None of the above

Question 7 (Weight 10%)

The most common form of time-of-use pricing is a 2 part definition with on-peak and off-peak.
(x)True ← Correct answer
( )False

Question 8 (Weight 10%)

On-peak refers to periods of relatively _____ demand.

( )a. Low
( )b. Stagnant

(x)c. High ← Correct answer
( )d. Both a and b

Question 9 (Weight 10%)

A time of use rate structure includes the following conditions
Monday - Friday, 10 AM - 8 PM, 8.9c per kWh
Monday - Friday, 8 PM - 10 AM, 4.3c per kWh
Saturday and Sunday, 4.3c per kWh

A facility consumed 400,000 kWh during peak periods, and 250,000 kWh during off-peak periods.
How much could they reduce their energy charge if they shift 80,000 kWh from peak to off-peak?

( )$3,440.00
(x)$3,680.00 ← Correct answer
( )$46,350.00
( )$368,000.00

Question 10 (Weight 10%)

Shoulder periods are the times between On-Peak and Off-Peak periods, and exist to allow more pricing options.
(x)True ← Correct answer
( )False

4.ENERGY RATE STRUCTURES PART 2: UNDERSTANDING AND REDUCING YOUR BILL

Question 1 (Weight 10%)

The demand charge is

(x)The portion of the bill where utility companies charge for having the capacity and infrastruct
available to meet the peak utilization during the billing period
( )A charge based on previous peak demand to cover the cost of having capacity and infrastructu
available at any time
( )A fixed monthly charge based on the costs associated with connecting a customer to the comp
distribution system
( )The portion of the bill based on total energy (kWh) consumed during the billing month and
calculated under the applicable rate schedule
( )A surcharge for the cost of fossil fuels

Question 2 (Weight 10%)

Which of the following factors may have an impact on demand charges?
( )Price
( )Subscribed power
( )All of the above
(x)Monthly peak demand

Question 3 (Weight 10%)

The fuel cost is
(x)The portion of the bill based on total energy (kWh) consumed during the billing month and
calculated under the applicable rate schedule
( )A surcharge for the cost of fossil fuels
( )A fixed monthly charge based on the costs associated with connecting a customer to the comp
distribution system
( )A charge based on previous peak demand to cover the cost of having capacity and infrastructu
available at any time
( )The portion of the bill where utility companies charge for having the capacity and infrastructu
available to meet the peak utilization during the billing period

Question 4 (Weight 10%)

Customers on Real Time Pricing rates have the potential for considerable savings if they can mo
energy from high price periods to low price periods, or reduce energy use during high price peri

(x)T
( )F

Question 5 (Weight 10%)

The demand ratchet is

( )The portion of the bill where utility companies charge for having the capacity and infrastructu
available to meet the peak utilization during the billing period
( )The portion of the bill based on total energy (kWh) consumed during the billing month and
calculated under the applicable rate schedule
( )A fixed monthly charge based on the costs associated with connecting a customer to the comp
distribution system
( )A surcharge for the cost of fossil fuels
(x)A charge based on previous peak demand to cover the cost of having capacity and infrastruct
available at any time

Question 6 (Weight 10%)

The customer service charge is

(x)A fixed monthly charge based on the costs associated with connecting a customer to the comp
distribution system
( )A surcharge for the cost of fossil fuels
( )The portion of the bill based on total energy (kWh) consumed during the billing month and
calculated under the applicable rate schedule
( )A charge based on previous peak demand to cover the cost of having capacity and infrastructu
available at any time
( )The portion of the bill where utility companies charge for having the capacity and infrastructu
available to meet the peak utilization during the billing period

Question 7 (Weight 10%)

Setting a new peak demand can affect both the demand charge for the month the peak is set as w
the bill for the following year.

( )F

(x)T

Question 8 (Weight 10%)

The energy charge is

( )b. A charge based on previous peak demand to cover the cost of having capacity and infrastru
available at any time

( )A fixed monthly charge based on the costs associated with connecting a customer to the comp
distribution system

( )A surcharge for the cost of fossil fuels

( )The portion of the bill where utility companies charge for having the capacity and infrastructu
available to meet the peak utilization during the billing period

(x)The portion of the bill based on total energy (kWh) consumed during the billing month and
calculated under the applicable rate schedule

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 9 (Weight 10%)

Multiplying the energy consumption by the price per kWh will give you the

(x)Energy cost

( )Billing demand

( )Consumption charge

( )Fuel adjustment

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 10 (Weight 10%)

Real-time pricing response is when a customer

( )Shares its power generation with companies in the surrounding area
( )Periodically renegotiates the energy tariff
(x)Uses a generator to produce its own power for high price periods
( )None of the above
( )Returns power back to the utility company

5.POWER FACTOR & HARMONICS

Question 1 (Weight 10%)

The _____ is the power required to produce the magnetic fields to enable the real work to be do
( )Active power
(x)Reactive power
( )Power factor
( )Real power

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 2 (Weight 10%)

_____ are caused by nonlinear loads connected to the distribution system.
( )Sinusoidal voltage waveforms
(x)Harmonic currents
( )Fast reactive energy compensators
( )Harmonic filters

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 3 (Weight 10%)

_____ is a systematic variation of the voltage waveform or a series of random voltage changes o
small dimensions.
( )Harmonic filter
(x)Voltage fluctuation
( )Fast reactive energy compensator
( )Capacitor bank

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 4 (Weight 10%)

True or false? When looking at individual (or local) compensation, the capacitor bank is directly connected to the terminals of the machine (generally motors). This is the best technical solution because reactive energy is supplied where it is needed.

(x)T
( )F

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 5 (Weight 10%)

_____ are implemented when power factor correction is requested with a high level of existing harmonic distortion.

( )Sinusoidal voltage waveforms
( )Active filters
(x)Passive filters
( )Variable speed drives

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 6 (Weight 10%)

Which solution can be used for mitigating variable speed drive power problems?

( )Capacitor-less
( )AC-Line or DC-link reactors
( )Multi-pulse arrangement
(x)All of the above

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 7 (Weight 10%)

The _____ is the actual power, or watts that produce real work. This component is the energy tra component, which represents fuel burned at the power plant.

(x)Active power
( )Reactive power

( )Magnetizing power
( )Apparent power

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 8 (Weight 10%)

A facility is operating with a demand of 3000 kW. The 5000 kVA transformer is fully loaded. H many kvar are required to bring the power factor back to unity?
( )3,000 kvar
( )4,000 kvar
( )5,000 kvar
(x)6,000 kvar

Score: 0.00% Score in test: 0.00% × 10 = 0.00%

Question 9 (Weight 10%)

Consider a 200 HP electric motor that has the following information on the name plate: 500 volt 228 amps, Three phase, 86% efficient, all at full load. What is the power factor of this motor?
( )0.68
( )0.76
(x)0.88
( )0.93

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 10 (Weight 10%)

Which of the following is an example of a non-linear load?
( )TV sets
( )Microwave ovens
( )Fluorescent lighting
(x)All of the above

A PERFORMANCE OPPORTUNITY ROADMAP

Question 1 (Weight 10%)

When a large motor fails, the most cost effective option is to rewind it:

( )True
(x)False ← Correct answer
( )Unknown

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 2 (Weight 10%)

Isolation transformers and soft starters are possible solutions for:

( )Motor efficiency problems
(x)Power quality problems ← Correct answer
( )Load cycle distribution
( )Reducing maintenance
( )Improving power factor

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 3 (Weight 10%)

Motors with three-phase supply will have significantly reduced efficiency if the voltage is not balanced among the phases. This can be caused by

( )Too many single phase loads on one of the three phases
( )Different size cables carrying the phases
( )Open circuit on a phase
(x)All of these answers ← Correct answer

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 4 (Weight 10%)

Larger motors have inherently higher rated efficiency than smaller motors:

(x)True ← Correct answer
( )False

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 5 (Weight 10%)

Lubricant analysis, infrared scanning and vibration analysis are all examples of:

( )Planned maintenance / operational monitoring
( )Corrective maintenance / status monitoring
(x)Predictive maintenance / condition monitoring ← Correct answer
( )Offline maintenance / indirect monitoring

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 6 (Weight 10%)

A motor in your plant is about fifteen years old, typically operates for about 12 hours per day year-round at about 60% loading serving a constant load. This motor has failed: what is your course of action?

( )Replace it with one which is larger size and higher efficiency, to be able to maintain output even when input voltages are abnormally low
( )Replace it with one which is the same size to have a safety factor to be able to cope with peak load
( )Replace it with one which is the sized smaller but with the same efficiency as the existing model
(x)Replace it with one which is sized smaller and higher efficiency ← Correct answer

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 7 (Weight 10%)

Motors that are consistently operated below 40% of capacity can be electrically downsized by changing from delta to star mode.

(x)True ← Correct answer
( )False

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 8 (Weight 10%)

How would you size a motor for loads which occasionally vary by about 10%?

( )Choose a motor rated 10% lower than the highest anticipated load and with a 15% service factor so that it will not overload for short periods
( )Choose a motor which is rated for 100% of the highest anticipated load and a 15% service factor so that it will not overload for short periods
( )Choose a motor which is rated for 105% of the highest anticipated load
(x)Choose a motor rated 10% lower than the highest anticipated load and with a 15% service factor and allow it to occasionally overload for short periods ← Correct answer

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 9 (Weight 10%)

The main disadvantage of overheated motors is.

( )Decline in motor efficiency by as much as 10%
(x)Premature failure of insulation, by as much as 50% of life ← Correct answer
( )Increase in cooling load in the plant
( )Increase in harmonic effects transmitted to the electrical network by as much as 5%

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 10 (Weight 10%)

Insulation resistance should be checked at moderate voltage to ensure that insulation is not wet before energizing an idle motor, to prevent catastrophic failure. Subsequently the test should be done at high voltage to look for dielectric weaknesses that may cause failure when the motor is operating

(x)For an idle motor both these tests are advisable ← Correct answer
( )For an idle motor only the moderate voltage test is required: this will also show dielectric weaknesses
( )For an idle motor only the high-potential test is required: wet insulation can be determined by visual inspection
( )Neither of these tests are necessary unless the motor was recently rewound

Active Energy Efficiency Using Speed Control

Question 1 (Weight 10%)

What is the main alternative to variable speed control in fan and pump applications?

( )Changing to an interruptable tariff
( )Reducing the operating hours of the equipment
(x)Using a valve or damper to adjust the flow
( )None of the above

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 2 (Weight 10%)

Electronic Variable Speed Drives

( )Make starting and stopping operations smooth and controlled
( )Minimize inrush currents
( )Convert mains AC supply into a tunable frequency and voltage
(x)All of the above

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 3 (Weight 10%)

Which of the following is the most common motor starting method available on the market under 10kW (15Hp)?

(x)Direct-on-line
( )Star/delta
( )Soft starting
( )None of the above

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 4 (Weight 10%)

This starting method progressively increases the motor voltage so that the motor becomes strong enough to accelerate the load to rated speed without causing torque or current peaks.

( )Direct-on-line
( )Star/delta
(x)Soft starting
( )None of the above

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 5 (Weight 10%)

Which of the following drive and has very accurate speed and torque control?

( )Gear box
(x)Frequency converter
( )Eddy current
( )Damper

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 6 (Weight 10%)

Which of the following is an advantage of variable speed control?

( )Controlled start and stop
( )Accuracy
( )Mechanical protection
(x)All of the above

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 7 (Weight 10%)

Chokes, passive filters and C-less drives are used in conjunction with variable speed drives to reduce the effects of what?

(x)Harmonics
( )Belts
( )Linear loads
( )Input shafts

Score: 100.00% Score in test: 100.00% × 10 = 10.00%

Question 8 (Weight 10%)

Using variable speed drives, the highest potential energy savings can be found on

( )C-less drives, DC chokes, and passive filters
( )AC chokes, multi-pulse drives, and active filters
(x)Pumps, fans and compressors
( )Hoisting, Conveyors, generators

Question 9 (Weight 10%)

Which of the following conditions have the potential to negate the value of a variable speed drive?

( )Energy is very cheap
( )Valves or dampers are normally set in a fully open position
( )Payback period or internal rate of return that does not meet company financial criteria
(x)All of the above

Question 10 (Weight 10%)

An energy saving opportunity is identified on a fan installation. The flow from the fan can be reduced from 100% of nominal output to 75%. According to the affinity laws, how much power will be saved at this output, compared to the power used to supply 100% of the flow?"

( )25%
( )40%
(x)58%
( )75%

9.Pumping Systems I: Pump Types and Performance

Although pumps are available in a wide range of types, sizes, and materials, they can be broadly classified into two categories. These are:

- Axial and negative displacement
- Positive displacement and centrifugal
- Spinning impeller and kinetic
- Collapsing volume and diffuser

Score: 100%

Question

Which type of pump would you choose for a system handling low-viscosity liquids across a broad range of conditions? You prefer a pump that is simple and safe to operate and requires minimal maintenance.

- Axial
- Centrifugal
- Kinetic
- Positive displacement

Score: 100%

Question

This type of pump is chosen for efficiency, effective with highly viscous liquids, generates high-pressure in low-flow applications and is ideal for metered or precisely controlled applications

- Negative displacement
- Centrifugal
- Spinning impeller
- Positive displacement

Score: 100%

Question

How is the flow rate of a positive displacement pump determined?

- A performance curve defines the flow that the pump will produce depending on the system pressure

- [x] Every stroke of the pump displaces the same volume. Therefore the flow rate is directly proportional to the speed.
- [ ] By reference to a coverage chart
- [ ] By trial and error

Score: 100%

Question

How is the flow rate of a centrifugal pump determined?

- [x] A performance curve defines the flow that the pump will produce depending on the system pressure.
- [ ] Every stroke of the pump displaces the same volume. Therefore the flow rate is directly proportional to the speed.
- [ ] By reference to a coverage chart
- [ ] By trial and error

Score: 100%

Question

The system curve is?

- [ ] The combined effect of viscosity and vapor pressure plotted as a curve. The intersection of the system curve and the pump performance curve determines the minimum pressure to avoid cavitation.
- [x] The combined resistance to flow of the pipes, valves and other components, plotted as a curve. The intersection of the pump performance and system curves determines the actual pressure and flow.
- [ ] The combined heat transfer requirements resulting from heat exchanger quantity, size and flow demands, plotted as a curve. The overlap between the system curve and the coverage chart determines what size of pump is required.
- [ ] None of the above.

Score: 100%

Question

The efficiency of a pump is equal to the pump's fluid power divided by the pump shaft power

- [x] True
- [ ] False

Score: 100%

Question

The total head of a fluid system consists of four measurements. Those four measurements are:

- (•) Static pressure, height, frictional head, velocity head (related to kinetic energy)
- ( ) Dynamic pressure, weight, frictional loss, cavitation density
- ( ) Static pressure, inlet pressure, discharge pressure, dynamic pressure
- ( ) Static pressure, compression pressure, expansion pressure, atmospheric pressure

Score: 100%

Question

Which of the following fluid characteristics influence pump requirements

- ( ) Viscosity
- ( ) Density
- ( ) Particulate content
- (•) All of the above

Score: 100%

Question

The name for the point at which a pump operates most cost-effectively in terms of both energy efficiency and maintenance.

- ( ) Allowable operating region
- (•) Best efficiency point
- ( ) Preferred operating region
- ( ) Cavitation point

10.Pumping Systems II

Question

Pumping systems have a wide range of flow needs. Sufficient pressure and flow must be guaranteed to satisfy system requirementâ€”flow control is essential to system performance. What mistake do designers typically make when it comes to sizing pumps and motors?

- ( ) Designers tend to undersize pumps and the motors that run them

- [x] Designers tend to oversize pumps and the motors that run them
- [ ] Designers do not typically make mistakes when it comes to sizing pumps and motors

Score: 100%

Question

What are the primary methods for controlling flow through a system or its branches?

- [ ] Downsizing valves, bypass valves, pump speed throttling, and pony pump arrangements
- [ ] Throttling valves, overpass valves, multiple pump speed bypass and peak flow valves
- [x] Throttling valves, bypass valves, pump speed control and multiple pump arrangements
- [ ] None of the above

Score: 100%

Question

How do bypass valves work, and what are the drawbacks to employing a bypass?

- [ ] Bypass valves and lines allow fluid to flow around a system component. A major drawback is their inflexibility. You must design the bypass at the beginning of the system, as it is extremely difficult to retrofit a bypass onto an existing system
- [ ] Bypass valves are easily corroded and are costly to install/replace. Bypassing requires repeatedly stopping and restarting of the pump which wears out the motor controllers and dynamic surfaces in the pump/motor assembly, all this leads to unreliable pump operation.
- [x] Bypass valves and lines allow fluid to flow around a system component. A major drawback is their detrimental impact on system efficiency. The power used to pump the bypassed fluid is wasted
- [ ] All of the above

Score: 100%

Question

Which of the following flow control methods is the most wasteful of energy?

- [x] Throttle valve

- Variable speed drive
- Multiple speed pump
- Parallel pumps
- Large / small pump combination

Score: 100%

Question

Which is the most popular type of adjustable speed drive?

- TextVariable frequency drive
- Adjustable belts and pulleys
- Eddy current clutch
- Hydraulic clutch

Score: 100%

Question

The shaft speed of the motor is related to the power absorbed by the pump by:

- A directly proportional relationship
- A fractional relationship
- A cubic relationship
- None of the above

Score: 0%

Question

When is a large pump / small pump combination recommended?

- When normal system operation is interspersed by occasional periods of high demand
- When system requirements vary continuously

- When system requirements vary in multiple well defined steps
- All of the above

Score: 0%

Question

A pump operated at 500 RPM is producing 10.0 metres of head or 32.8 feet of head. What will the resulting head be if the speed is reduced to 420 RPM?

- 7.1 metres of head or 23.1 feet of head
- 5.9 metres of head or 19.4 feet of head
- 8.4 metres of head or 27.6 feet of head
- None of the above

Score: 0%

Question

Analysis has determined that a pump is oversized for the application. The pressure of the pump can be reduced by 35%. In an ideal case, what will the reduction in speed be?

- 13%
- 19%
- 35%
- 75%

Score: 100%

Question

How does a throttle valve work?

- A throttle valve throttles the fluid flow so that more fluid can move through the valve, creating a pressure increase across it

- [x] A throttle valve chokes fluid flow so that less fluid can move through the valve, creating a pressure drop across it
- [ ] A throttle valve bypasses the flow so that upstream pressure is maintained and fluid is pushed throughout the parallel branches of the system
- [ ] Throttle valves decrease the head on the pump, which may push it towards the best efficiency point (BEP) and make it more efficient.

11.Financial Analysis of Projects I

Question

A facility manager wants to obtain approval for purchase of a new air compressor. The cost is €80,000. The savings over a three year period are €120,000. What is the simple ROI for this three year period?

- [x] 50%
- [ ] -50%
- [ ] 150%
- [ ] 200%

Score: 100%

Question

Which method of financial evaluation takes into account all the costs of ownership such as energy and maintenance as well as initial purchase price?

- [ ] Rate of return analysis
- [ ] Marginal return analysis
- [ ] Simple payback
- [x] Life cycle costing

Score: 100%

Question

In the third year of a project, the costs are €5,000 and the savings are €23,000. What is the present value of this cash flow assuming an interest rate of 9.5%

- €19,710
- €2,427
- €17,518
- €13,709

Score: 100%

Question

An energy efficiency project is projected to have the following discounted cash flows: Year 1: $15,000. Year 2: $12,000. Year 3: $10,000. The initial cost is $40,000. Based on the net present value of the project, would you approve this investment?

- Yes
- No
- Not enough information is given to decide

Score: 100%

Question

The internal rate of return is the interest rate that is equivalent to the returns from the project. It is equivalent to the interest rate that results in an NPV of zero.

- True
- False

Score: 100%

Question

An energy efficiency project is projected to have the following discounted cash flows: Year 1: $15,000. Year 2: $12,000. Year 3: $10,000. The initial cost is 320,000.

Company rules state that projects with a discounted payback of less than 2.5 years qualify for capital investment. Does this project qualify?

- Yes
- No
- Not enough information is given

Score: 100%

Question

Salvage value is the value of the equipment at the end of the project, excluding any costs for decommissioning or disposal.

- True
- False

Score: 100%

Question

Money that a company spends to buy or upgrade physical assets such as property, buildings or equipment is known as…

- OPEX
- Revenue
- CAPEX
- Interest

Score: 100%

Question

What are the advantages and disadvantages of simple payback period as a tool for financial evaluation?

- It readily incorporates recurring investments. But it does not evaluate the overall risk of the project.

It can be easily compared to the minimum attractive rate of return. But it has to be estimated by trial and error to find the zero NPV.

It is simple to calculate and understand, and is widely used. But it ignores benefits after the payback period and does not capture the total project value.

All of the above

Score: 100%

Question

An energy auditor recommends installation of lighting controls. The cost of the retrofit is $40,000 and the annual savings are $18,000. What is the simple payback period of this project?

0.5 years

2.2 years

0.6 years

1.2 years

12.Compressed Air Systems I: An Introduction

Question

Sound, energy efficient operating practices inside the compressed air system can lead to a significant reduction in costs and reduce energy consumption by 20% to 50%.

False

True

Score: 100%

Question

Optimization of the compressed air system can lead to:

Reduced maintenance

- Less downtime
- Increased production and product quality
- All of the above

Score: 100%

Question

Why is compressed air a relatively inefficient source of power?

- 60 to 80% of the power consumed to make compressed air is converted into heat
- 60 to 80% of the power consumed to make compressed air is lost in friction and pressure drops
- 60 to 80% of the power consumed to make compressed air is lost due to oil contamination
- 60 to 80% of the power consumed to make compressed air is lost due to inefficient control methods such as throttling

Score: 100%

Question

Which of the following statements is NOT true.

- Gauge pressure is the sum of absolute pressure and atmospheric pressure
- Absolute pressure is measured compared to a perfect vacuum. Gauge pressure is pressure above atmospheric pressure.
- Gauge Pressure is the difference between absolute pressure and atmospheric pressure
- Atmospheric pressure is generally accepted as 1.013 bar a or 14.7 psi a.

Score: 0%

Question

A standard cubic foot and a standard cubic metre of air are compressed to one-eighth of their original volume. What is the result?

- 0.125 standard cubic foot and 0.125 standard cubic metre of compressed air

- 0.5 cubic foot and 0.5 cubic metre of free air delivered
- 1 standard cubic foot and 1 standard cubic metre of air if allowed to return to standard conditions
- None of the above

Score: 0%

Question

In a compressed air system, the supply side focuses on how compressed air is distributed and utilized for productive use, and the demand side deals with how compressed air of the required quality should be efficiently produced.

- False
- True

Score: 0%

Question

Why are compressed air systems overlooked as a source of energy efficiency savings?

- Systems are not well understood by plant operations staff
- Modifying a system is perceived as a risk to production
- Vendors compete in a market where equipment is typically sold on a “lowest first bid”, without regard for the cost of operation
- All of the above

Score: 100%

Question

_____ is volume flow referenced from the conditions at the compressor inlet.

- Inlet flow
- Actual flow
- FAD

- Standard flow

Score: 100%

Question

Compressed air requirements include

- Cleanliness
- Dryness
- Oil content
- All of the above

Score: 100%

Question

Over the lifetime of a compressed air system, approximately _____ of the total cost of ownership is energy.

- 20%
- 40%
- 60%
- 80%

13.Fan Systems I Introduction to Fan Performance

What determines the actual airflow from a fan?

- The rotational speed of the fan
- The intersection of the fan performance curve and the system curve
- The best efficiency point

- The power input to the fan and its efficiency rating

Score: 100%

Question

In an effort to protect against inadequate system performance, designers tend to oversize fans.

- False
- True

Score: 100%

Question

Flow is proportional to which of the following?

- Pressure cubed
- Speed squared
- Rotational speed
- Shaft speed squared

Score: 100%

Question

What are the benefits of operating a fan close to its BEP?

- Improved performance and reduced energy consumption
- Reduced wear on bearings and decreased noise
- All of the above
- Longer maintenance intervals and lower maintenance

Score: 100%

Question

If the airflow running through an air system is changed, the resulting _____ will also change.

- Temperature
- Moisture
- Pressure loss
- Fan rotation

Score: 0%

Question

A fan operated at 300 RPM is producing 1.0 bar g or 14.5 psig of pressure. What will the resulting pressure be if the speed is reduced to 225 RPM?

- 0.56 bar g or 8.2 PSIG
- 1.78 bar g or 25.8 PSIG
- None of the above
- 0.75 bar g 10.9 PSIG

Score: 100%

Question

Analysis has determined that a fan is oversized for the application. The airflow of the fan can be reduced by 15%. In an ideal case, what will the reduction in power be?

- 0%
- 15%
- 39%
- 61%

Score: 100%

Question

Which of the following are ways to reduce fan system noise levels?

- Mounting fan on soft material
- Insulating ducts
- Installing sound dampening material or baffles
- **All of the above**

Score: 0%

Question

What is the system effect?

- The combination of the loss coefficient of the system components together with the impact of non-uniform airflow profiles
- The relationship between fan speed and power, which causes non-linear reduction in power consumption with reduced speed
- The relationship between the system components and the fan performance characteristics
- The reduced capital investment required when sourcing all parts of a system from the same vendor

Score: 100%

Question

Oversized fans contribute to higher energy and capital costs, but are more reliable and require less frequent maintenance

- True
- False

14. Fans Systems II: Fan Types

Question

Which of the following are technical attributes that need to be considered when choosing a fan?

- Pressure
- Airflow rate
- Efficiency
- All of the above
- None of the above

Score: 100%

Question

Centrifugal fans act like propellers, generating airflow along the direction of the fan's axis.

- True
- False

Score: 100%

Question

Which of the following is NOT a centrifugal fan blade type?

- Forward-curved
- Vaneaxial
- Radial-tip
- Backward-inclined

Score: 100%

Question

Which fan type is well suited to handling high-particulate airstreams?

- (•) Radial-blade
- ( ) Airfoil
- ( ) Backward-curved
- ( ) Forward-curved

Score: 100%

Question

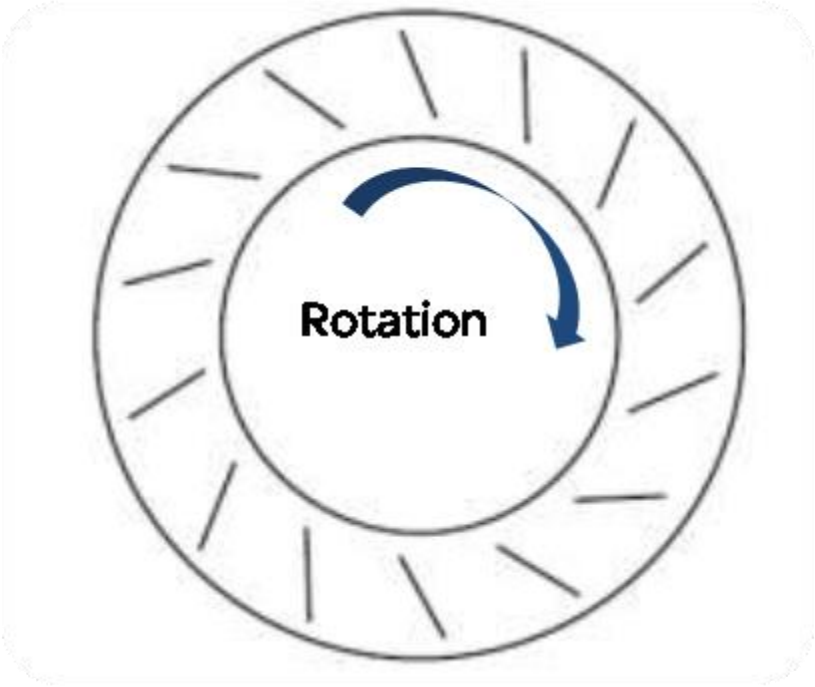
The key advantage of axial airflow fans is that they are compact, low-cost, and lightweight.

- (•) True
- ( ) False

Score: 100%

Question

The following image is an example of what fan type?



- Forward-curved
- Backward-inclined
- Backward-inclined airfoil
- Radial tip

Score: 100%

Question

Vaneaxial fans are often equipped with variable pitch blades, which can be adjusted to change the angle of attack to the incoming airstream.

- True
- False

Score: 100%

Question

Which of the following fan types can be operated in the reverse direction?

- Tubeaxial
- Vaneaxial
- Propeller
- All of the above

Score: 100%

Question

Which of the following is NOT an advantage of using multiple fans instead of large fans?

- High efficiency – each fan can be operated close to its best efficiency point
- Redundancy – if a fan incurs downtime the others can still work
- Flexible purchasing – fans of different sizes and models can readily be combined to meet variable loads
- Lower noise generation

Score: 100%

Question

Which of the following fan types is frequently used in medium-pressure ducted HVAC applications?

- Forward-curved
- Backward-incline
- Tubeaxial
- Propeller

Score: 100%

15.HVAC and Characteristics of Air

Question

A sample of air at dry bulb temperature 70°F / 21.11°C has a relative humidity of 50%. If the temperature falls, what happens to the relative humidity?

- Stays the same
- Decreases
- Increases

Score: 100%

Question

How is wet bulb temperature determined?

- Using a thermometer with a wetted sensing tip
- Using a barometer
- Using a humidity sensor
- Any of the above

Score: 100%

Question

Simple heat and sensible heat are the same. Enthalpy and latent heat are the same.

- T
- F

Score: 100%

Question

If the wet bulb temperature rises, what else would you observe?

- Relative humidity is also
- Latent heat is also increasing
- Enthalpy is decreasing
- A and B
- B and C

Score: 0%

Question

A sensible heat recovery system operates as part of an air conditioning system. The outside air temperature is 60°F and the exhaust air temperature is 80°F. The system operates at 68% efficiency and processes 35,000 cfm.

- 414,080 BTU/hr
- 514,080 BTU/hr
- 524,080 BTU/hr
- 614,080 BTU/hr

Score: 100%

Question

The heat in moist air derived from the energy required to cause water to change state is

- Enthalpy
- Latent heat
- Sensible heat
- Humid heat
- All of the above

Score: 100%

Question

A total heat recovery system operates on an airflow of 45,000 cfm. The incoming air enthalpy before the heat exchanger is 30.0 Btu/lb. The exhaust air has enthalpy of 38.5 Btu/lb. What is the maximum heat that can theoretically be recovered by this system?

- 1,581,240 BTU/hr
- 1,621,650 BTU/hr
- 1,721,250 BTU/hr
- 1,921,950 BTU/hr

Score: 100%

Question

If a heat recovery system saves 443,535 BTU per hour and runs 6.5 hours per day all year, 5 days per week, how much is it saving if electricity costs 7.8c per kWh? Calculate to the nearest $10.

- $16,150.00 / year
- $17,140.00 / year
- $20,130.00 / year
- $22,150.00 / year

Score: 0%

Question

What is the temperature at which the air can no longer contain all its moisture, and water will begin to condense out of the air?

- Dew Point Temperature
- Dry Bulb Temperature
- Wet Bulb Temperature

- Latent Heat

Score: 100%

Question

Which temperature reading from a thermometer gives us a good representation of the level of sensible heat in a sample of air?

- Dew Point Temperature
- Dry Bulb Temperature
- Enthalpy
- Relative humidity