

X

NPTEL

reviewer4@nptel.iitm.ac.in ▾

Courses » RAC Product Design Announcements **Course** Ask a Question Progress Mentor FAQ

Unit 6 - WEEK 4

Course outline

How to access the portal

Pre-requisite ASSIGNMENT

WEEK 1

WEEK 2

WEEK 3

WEEK 4

Vibration and noise issues in railway AC systems

New product launch process

Case study on a telecom cooling system and Emerging technologies

Quiz : Assignment 4

Solution of Assignment Problems

Assignment 4

The due date for submitting this assignment has passed. **Due on 2018-09-16, 23:59 IST.**
As per our records you have not submitted this assignment.

(A)

1) The use of free cooling to lower annual energy consumption is relevant in **1 point**

- Winter Months in tropical climates when temperature is at least 5°C below target temperature of conditioned space
- All throughout the year in cold climates with year-round ambient temperatures at least 5°C lower than temperature targeted in the conditioned space
- Any climate irrespective of target temperature
- Cooling of equipment in Dry summer when temperatures are above 46°C and target temperature of conditioned space is 30°C

No, the answer is incorrect.

Score: 0

Accepted Answers:

Winter Months in tropical climates when temperature is at least 5°C below target temperature of conditioned space

All throughout the year in cold climates with year-round ambient temperatures at least 5°C lower than temperature targeted in the conditioned space

2) Which of the following methods isn't suitable to reduce the risk from fire. **1 point**

- Usage of fire retardant material for control boxes
- Protecting wire insulation from sharp ends
- Use of refrigerants with a low flammability limit
- Eliminating sources of ignition in areas where flammable refrigerant may leak

No, the answer is incorrect.

Score: 0

Accepted Answers:

Use of refrigerants with a low flammability limit

3) Relative to the direction of train movement, in which direction are churning shocks experienced. **1 point**

© 2014 NPTEL - Privacy & Terms - Honor Code - FAQs -



A project of



NPTEL

National Programme on Technology Enhanced Learning

In association with

NASSCOM®

Funded by

No, the answer is incorrect.

Score: 0

Accepted Answers:

Longitudinal

4) The Rajdhani and Shatabdi trains currently in service today have which type of air conditioning equipment? **1 point**

- Ductless split AC units
- An open semi-hermetic compressor which is underslung
- Compressor driven by wheels of the carriage
- Two roof mounted package units placed on each end of the coaches

No, the answer is incorrect.

Score: 0

Accepted Answers:

Two roof mounted package units placed on each end of the coaches

5) The material of the flexible refrigerant line that was proposed during re-design in the case study on railway coach AC was: **1 point**

- Aluminium
- Copper
- Bronze
- Red Brass

No, the answer is incorrect.

Score: 0

Accepted Answers:

Copper

6) In the railway coach AC case-study, a problem was encountered in field in which the AC unit tripped when the train was stationary at the platform for too long. The root cause for this problem was identified as: **2 points**

- An electrical malfunction of the unit's control board.
- Short-cycling of hot air over the condenser due to station shed's design
- The High Pressure safety cutout tripped due to highcondensing pressure
- The refrigerant lines got ruptured due to shunting of coaches
- The compressor did not get adequate power supply as the train was stationary.

No, the answer is incorrect.

Score: 0

Accepted Answers:

Short-cycling of hot air over the condenser due to station shed's design
The High Pressure safety cutout tripped due to highcondensing pressure

7) What design change was done to reduce short cycling of air in the condenser of the roof mounted package AC unit? **2 points**

- To re-design the control board with adequate dielectric strength to handle heavy electric loads.
- To provide a small annularextension of 20mm height ahead of the propeller fan
- To replace the existing refrigerant lines with more robust tubes of larger dimensions
- Switching off the AC units at railway stations by embedding the logic onto the control board

No, the answer is incorrect.

Score: 0

Accepted Answers:

To provide a small annularextension of 20mm height ahead of the propeller fan

8) In the case study of vibration induced failures, select from the following, the measures taken to **2 points** address the problem:

- To increase the natural frequency of the compressor
- To replace mountings with more flexible rubber mountings
- To replace corrugated braided connectors with flexible copper tubes designed for specific natural frequency.
- To replace the existing rubber mountings on the compressor baseplate with rigid mountings

No, the answer is incorrect.

Score: 0

Accepted Answers:

To replace corrugated braided connectors with flexible copper tubes designed for specific natural frequency.

To replace the existing rubber mountings on the compressor baseplate with rigid mountings

9) In a Telecom Shelter AC application, which of the following statement(s) hold(s) TRUE ? **2 points**

- The equipment load is purely latent.
- The load on AC unit is mostly sensible and slightly latent due to infiltration
- Fresh air requirement is a must for smooth operation.
- There is an opportunity to reduce operating cost by using ambient air if the outdoor temp is sufficiently low.

No, the answer is incorrect.

Score: 0

Accepted Answers:

The load on AC unit is mostly sensible and slightly latent due to infiltration

There is an opportunity to reduce operating cost by using ambient air if the outdoor temp is sufficiently low.

10) Which of the following scenarios may result in the formation of ice over the evaporating coil an **2 points** AC unit?

- Low quantity of refrigerant
- Blocked air filter
- Blocked of evaporator coil heat transfer area
- Too much throttling in the expansion device

No, the answer is incorrect.

Score: 0

Accepted Answers:

Low quantity of refrigerant

Blocked air filter

Blocked of evaporator coil heat transfer area

11) A start-stop test can be used for testing the life of which of the following: ? **2 points**

- Motor winding
- Fans, blowers, etc.
- Compressor's reliability in high ambient
- Oil retainment in compressor

No, the answer is incorrect.

Score: 0

Accepted Answers:

Motor winding

Fans, blowers, etc.

12) Select the TRUE statement(s):

2 points

- Vibration induced failures occur when the component is over-designed
- Vibration induced failures occur when the component is subjected to overdamped oscillations.
- Vibrations induce cyclical loads on the component that may induce fatigue failure.
- Large displacement of components relative to each other can be caused due to shocks and resonance.

No, the answer is incorrect.**Score: 0****Accepted Answers:***Vibrations induce cyclical loads on the component that may induce fatigue failure.**Large displacement of components relative to each other can be caused due to shocks and resonance.*

13) Which of the following is true with respect to oil free compressors?

2 points

- It has lower efficiency at low load conditions Vs conventional compressors that use oil.
- High RPM enables a compact construction of the compressor.
- Partial load operating efficiency decreases with the use of multiple compressors.
- The compressor has a competitive advantage for use of new environmentally safe refrigerants as it removes the constraint of oil miscibility that is needed in conventional compressors

No, the answer is incorrect.**Score: 0****Accepted Answers:***High RPM enables a compact construction of the compressor.**The compressor has a competitive advantage for use of new environmentally safe refrigerants as it removes the constraint of oil miscibility that is needed in conventional compressors***(B)**

A railway coach air conditioning system with the design occupancy of 70 passengers and is to be maintained at 25°C DBT and 50%RH and the outside air temperature is 37°C DBT and 27°C WBT. The average heat generated by each passenger is 150W and the recommended ventilation rate per person is 12.75 m³/hr (corresponding to internal specific volume conditions). The supply air condition of the coil is 14°C DBT and 85% RH.

14) Determine the load on the evaporator coil due to the outside air. Note: Answer is in kW. Only enter the value

No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Range) 12.5,14.5*

3 points

15) Determine the total capacity of air conditioning system required to cater to the passenger loads. Note that the load on the AC system would include both passenger load as well as load due to fresh air. Answer is in kW . Enter only the value

No, the answer is incorrect.**Score: 0****Accepted Answers:***(Type: Range) 19,21*

3 points

(C)

A free cooling arrangement is proposed to be implemented in a railway coach with an installed rated capacity of 21 kW, during winter conditions of around 18°C DBT and 60% RH. The other data (comfort condition, etc.) are the same as in **PART (B)** above. The free cooling blower fan power consumption is 240 W per 3000 m³/hr and the AC EER is 3.0. ,

$$W_{fan} = \text{Rated Power}_{FAN} \times (0.371 + 0.973(PLR_{fan}) - 0.342(PLR_{fan})^2)$$

Where, PLR_{fan} is part load ratio defined by the ratio of air flow rate to the rated flow rate capacity of the fan.

$$(W)_{ACunit} = \text{Rated Power}_{AC unit} \times (0.179 + 0.739(PLR_{AC}) + 0.082(PLR_{AC})^2) / \text{Rated EER}$$

Where, PLR_{AC} is part load ratio defined by the ratio of rated cooling capacity to the actual cooling capacity of the AC unit.

16) Determine the total power consumption of AC unit in the absence of free cooling. Note: Answer is in kW. Enter only the value.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 2.5,3.5

2 points

17) Determine the flow rate of outside air (at outdoor conditions) for the purpose of free cooling to cater to the occupants' load.

Note: Answer is in m³/hr. Enter only the value.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 2400,2600

2 points

18) The percentage savings in power due to the free cooling operation as compared to the AC operation with only the minimum required amount of fresh air would be _____ %.

Note: Answer is in percentage. Enter only the value.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 90,95

2 points

(D)

A telecom shelter houses transmission equipment that needs to be maintained below 27 °C. The cooling requirement is 24x7 as the unit is in service throughout the year. The heat load is mostly sensible with an approximate value of 3.5 kW. A package air-conditioning unit with an adjustable damper arrangement, for the blower fan to switch between various modes of cooling (Free-cooling, Pre-cooling, AC cooling), is used to cater to the loads.

Assume that the specific heat of moist air is 1.02 kJ/kg.K.

Fan rated capacity = 1800 kg/hr

Fan rated power = 120 W

AC unit rated capacity = 4 kW

AC unit EER = 3.0

The blower fan power consumption is given by the equation

$$(W)_{Fan} = \text{Rated Power}_{fan} \times (0.371 + 0.629(\text{PLR}_{fan}))$$

Where, PLR_{fan} is part load ratio defined by the ratio of air flow rate to the rated flow rate capacity of the fan.

And the AC unit power consumption is given by

$$(W)_{ACunit} = \text{Rated Power}_{AC\ unit} \times (0.179 + 0.821(\text{PLR}_{AC})) / \text{Rated EER}$$

Where, PLR_{AC} is part load ratio defined by the ratio of rated cooling capacity to the actual cooling capacity of the AC unit.

Avg. Outdoor Temp Condition (°C)	Hours/Year	Operating Mode
15	2629	Free-Cooling
24	1688	Pre-Cooling
35	4443	AC-Cooling

19) In free cooling, the load is catered through admittance of fresh air alone without the operation of compressor unit. Determine the annual energy consumption of the unit operation in free cooling mode. Note: Answer is in kWh. Enter only the value.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 200,250

2 points

20) In pre-cooling mode, since the ambient air temp is less than the room's return air temperature, fresh air is admitted into the AC unit and the return air is exhausted. Determine the annual energy consumption of the unit's operation in pre-cooling mode. The value of EER, in this case, can be taken as 3.5. Note: Answer is in kWh. Enter only the value.

No, the answer is incorrect.

Score: 0

Accepted Answers:

(Type: Range) 1250,1400

2 points

21) In case the outdoor temp is greater than 27°C, then no fresh air is admitted into the room, and AC cooling mode is enabled which recirculates 100% return air. Determine the annual energy consumption of the unit's operation in the AC-cooling mode. EER for this mode of operation is 3. Note: Answer is in kWh. Enter only the value.

No, the answer is incorrect.

Score: 0

Accepted Answers:
(Type: Range) 5500,6200

3 points

Previous Page

End