



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Question Paper Format

School of HVAC&R Skills

1st Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA-1101

Time: 1 Hour

Course Name: Basic of Refrigeration and Air-Conditioning

Max. Marks: 20

Instructions:

1. Attempt all Questions.
2. Each question of Section – A carries 01 marks.
3. Each question of Section – B carries 02 marks.
4. Each question of Section – C carries 03 marks.

Section – A

05X01 = 05 Marks

1. The ratio of heat extracted in a refrigerator to the work done on the refrigerant is called:
 - a) The coefficient of performance of refrigeration
 - b) The coefficient of performance of the heat pump
 - c) Relative coefficient of performance
 - d) Refrigerating efficiency
2. The efficiency of the Carnot heat engine is 80%. The COP of refrigerator operating on the reversed Carnot cycle is equal to:
 - a) 0.25
 - b) 0.40
 - c) 0.60
 - d) 0.80
3. In which direction does the heat flow?
 - a) From a cold substance to cold substance
 - b) Up
 - c) Down
 - d) From a warm substance to a cold substance
4. ----- is the time rate of doing work.
 - a) Power
 - b) Work
 - c) Heat
 - d) Temperature
5. In the closed stationary system, the total energy is:
 - a) Kinetic energy
 - b) Potential energy
 - c) Internal energy
 - d) Sensible energy

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Section – B

03X02 = 06 Marks

1. What is the property of thermodynamic system? Write down any four properties of thermodynamic system.
2. Derive mathematical equation for work done by the closed system.
3. Differentiate between steady flow process and uniform flow process with an example.

Section – C

03X03 = 09 Marks

1. What is pressure? Write down different pressure units used in RAC. Explain absolute pressure, gauge pressure, and vacuum pressure with a neat diagram
2. (a) Explain different forms of energy. Write down the expression for the total energy of a system.
(b) Explain with a neat diagram specific heat at constant pressure and specific heat at constant pressure.
3. Define 1st and 2nd Law of Thermodynamics.

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B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA-1101

Time: 1 Hour

Course Name: Basic of Refrigeration and Air-Conditioning

Max. Marks: 20

Instruction: (Attempt all questions.)

Section A

- 1) a
- 2) a
- 3) a
- 4) a
- 5) c

Short answer: Section B

- 1) Properties are characteristics of a system. It represents the state of the system.
Four properties: Temperature, Pressure, volume, density
- 2) Pressure–volume work (or PV work) occurs when the volume V of a system changes. For a process in a closed system, work is represented by the following equation between differentials: $W=PdV$
- 3) Steady flow process: properties are invariant with time. $dT/dt = 0$
Uniform flow process: properties are invariant with position. $dT/dx = 0$

Long answer question Section C

- 1) Pressure: it is a normal force/unit area
Different pressure units are: N/m^2 , Pascal, Bar, atmospheric pressure, torr, PSI, mm of Hg.
Absolute pressure = atmospheric pressure+ gauge pressure (pressure above atmospheric)
Absolute pressure = atmospheric pressure- gauge pressure (pressure below atmospheric)
- 2). Different form of energy: kinetic energy, potential energy, internal energy all are stored form of energy. Heat and work are energy in transit.
Total energy= K.E. +P. E+ Internal energy
3. The first law of thermodynamics is a version of the law of conservation of energy, adapted for thermodynamic systems. The law of conservation of energy states that the total energy of an isolated system is constant; energy can be transformed from one form to another, but can be neither created nor destroyed. The first law is often formulated
Kelvin statement: It is impossible, by means of inanimate material agency, to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects.
Clausius statement: Heat can never pass from a colder to a warmer body without some other change, connected therewith, occurring at the same time.



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School of HVAC&R

I Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA1102

Time: 1 Hour

Course Name: Assembly and Installation of Refrigerator

Max. Marks: 20

- Instructions:
1. Attempt all the questions.
 2. Try to be precise while answering the questions.

Section – A

05X01 = 05 Marks

1. Refrigerant in the evaporator:
 - a. Changes from vapor to liquid.
 - b. Changes from liquid to vapor.
 - c. Stays in vapor state.
 - d. Stays in liquid state.
2. Which one of the following compressor types uses piston to compress the gas?
 - a. Scroll
 - b. Reciprocating
 - c. Rotary
 - d. Screw
3. Which refrigerant is used in a refrigerator?
 - a. R-22
 - b. R-32
 - c. R-134a
 - d. R-410a
4. The device which separates liquid from gas before compressor is:
 - a. Liquid receiver.
 - b. Filter drier.
 - c. Accumulator.
 - d. Expansion valve.
5. In a refrigeration system, the expansion device is connected between the:
 - a. Compressor and condenser.
 - b. Condenser and Evaporator.
 - c. Evaporator and compressor.
 - d. Accumulator and evaporator.

Section – B

03X02 = 06 Marks

1. What is the function of an evaporator in the Refrigeration system?
2. Describe the operation of a compressor.
3. Describe the changes found in refrigerant as it passes through condenser.

Section – C

03X03 = 09 Marks

1. Differentiate between Clausius and Plank statement.
2. What are the differences between heat pump, refrigerator and a heat engine?
3. Explain the principle of VCRS with a diagram.



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Answer Key

School of HVAC&R

I Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA1102

Time: 1 Hour

Course Name: Assembly and Installation of refrigerator

Max. Marks: 20

- Instruction: 1. Attempt all the questions.
2. Try to be precise while answering the questions.

Section – A

05X01 = 05 Marks

1. Refrigerant in the evaporator

- Changes from vapor to liquid.
- Changes from liquid to vapor.
- Stays in vapor state.
- Stays in liquid state.

Ans. b. Changes from Liquid to Vapor.

2. Which compressor type uses piston to compress the gas?

- Scroll
- Reciprocating
- Rotary
- Screw

Ans. b. Reciprocating

3. What refrigerant is used in a refrigerator?

- R-22
- R-32
- R-134a
- R-410a

Ans. c. R-134a

4. The device which separates liquid from gas before compressor is

- Liquid receiver.
- Filter drier.
- Accumulator.
- Expansion valve.

Ans. c. Accumulator

5. In a refrigeration system, the expansion device is connected between the

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- a. Compressor and condenser.
- b. Condenser and Evaporator.
- c. Evaporator and compressor.
- d. Accumulator and evaporator.

Ans. b. Condenser and Evaporator.

Section – B

03X02 = 06 Marks

1. What is the function of an evaporator in the Refrigeration system?

Ans. The function of evaporator is to work as heat exchanger i.e. to take away the heat from the nearby surrounding by passing the air over the cooling coil. It converts the liquid coming from the expansion device into low temperature, low pressure vapor.

2. Describe the operation of a compressor.

Ans. Compressor is the heart of the system. It acts as a pump and controls the flow of the refrigerant throughout the system. It converts low pressure, low temperature gas to high pressure, high temperature gas.

3. Describe the changes in refrigerant as it passes through condenser.

Ans. When refrigerant enters the condenser it slowly starts turning into liquid because it the ambient air which is coming over from coil because of the fan helps in taking away the heat of the refrigerant. As this air takes away the heat the refrigerant turns into liquid.

Section – C

03X03 = 09 Marks

1. State and differentiate between Clausius and Plank statement.

Ans. Clausius statement : Heat cannot spontaneously flow from cold regions to hot regions without external work being performed on the system. It can be understood by simple example of refrigeration. In a refrigerator, heat flows from cold to hot, but only when forced by an external agent, the refrigeration system. Kelvin Statement: It is impossible, by means of inanimate material agency, to derive mechanical effect from any portion of matter by cooling it below the temperature of the coldest of the surrounding objects.

2. What are the differences between heat pump, refrigerator and a heat engine?

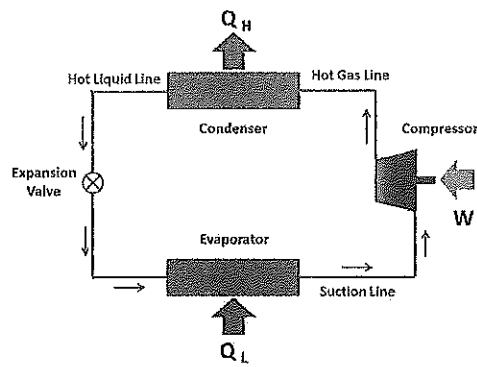
Ans.

1. In a heat engine, heat is transferred from a higher temperature reservoir called source to a lower temperature reservoir called sink. Work is obtained during this process.
2. A refrigerator is a reversed heat engine. Heat is transferred from the lower temperature level to higher temperature by applying external work to maintain the temperature below atmospheric temperature.
3. A heat pump is similar to a refrigerator. The only point of difference between the two is of the desired effect. The desired effect in a refrigerator are at the colder end, whereas desired effect in a heat pump are at the hotter end.

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3. Explain the principle of VCRS with a diagram.

Ans.



Vapor Compression Refrigeration system have 4 main components, using which lower temperatures is being produced and maintained:

1. Compressor
2. Condenser
3. Expansion valve
4. Evaporator.

Low pressure, low temperature liquid is converted to vapor in the evaporator, thus absorbing heat the latent heat from the refrigerated space and keeping that space cool. The fluid is driven around the cycle by the compressor, which compresses the low temperature, low pressure vapor leaving the evaporator to high pressure, high temperature vapor. That vapor is condensed to liquid in the condenser, thus giving off heat at a high temperature to the surrounding environment. Finally, the high pressure, high temperature liquid leaving the condenser is cooled and reduced in pressure by passing it through an expansion valve. This provides the input to the evaporator which was the first step of the cycle described above.



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I Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA-1103

Time: 1 Hour

Course Name: Assembly and Installation of Air-conditioning

Max. Marks: 20

Instruction: All Questions are compulsory.

Section – A

05X01 = 05 Marks

1. System based on natural refrigeration is;
 - a. Room Air conditioner
 - b. Fridge
 - c. Room desert Cooler
 - d. Package Air conditioner
2. ----- made the refrigerating machine to produce small quantity of ice by evaporating ethyl ether under vacuum;
 - a. Thomas Alva Edison
 - b. William Cullen
 - c. J N Beard
 - d. Albert Einstein
3. The most commonly used and cheapest type of air conditioners are;
 - a. Window AC
 - b. Split AC
 - c. Package Unit
 - d. Cassette Unit
4. The split air conditioner comprises two parts;
 - a. FCU and Evaporator
 - b. Pressure switch and Expansion Valve
 - c. Capillary and water cooling coil
 - d. the outdoor unit (ODU) and the indoor unit (IDU)
5. The window and split air conditioners are usually used for the small air conditioning capacities;
 - a. Up to 3 tons,
 - b. up to 5 tons,
 - c. up to 10 tons,
 - d. up to 20 tons.

Section – B

03X02 = 06 Marks

1. What is part of system and what is part of surroundings in the Universe?
2. What is temperature? What are the units used to measure temperature?
3. Name any 5 types of Air Conditioner Systems.

Section – C

03X03 = 09 Marks

1. How will you install a Split System Air Conditioner?
2. How will you Vacuum AC line? Explain the procedure of vacuuming in split AC.
3. How to select the best location for installing split unit air-conditioner?



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School of HVAC&R Skills I

Semester, 1stIn-Sem.

B. Voc. Program, Summer/Winter Semester (2018-19)

Course Code: HVA1103

Time: 1 Hr

Course Name: Assembly and Installation of Air Conditioner

Max. Marks: 20

Section - A

1) c, 2) b, 3) a, 4) d, 5) b

Section - B

1. Space under observation in universe is system, beyond the boundary space in ~~universe~~ universe is surrounding.
2. Temperature is property of a system, which can be ~~measure~~ measure in terms of heatness.
- Q. Split, window, cassette, desert room cooler, package

Section - C

Ans 1

- ① locate the wall
- ② check the connection of electric unit
- ③ Mark location above 6 ft from ground and nearest to ceiling and drill holes of 90mm with core levelling.
- ④ Nail the wall and mount mounting plate with spirit level.
- ⑤ mount the I D U ~~with~~ on mounting plate and check with spirit level
- ⑥ install the copper tube with proper bending.
- ⑦ install the drain pipe
- ⑧ connect copper tubes and wire.

Am 2 :- The process of vaccuming A/C line is as follow.

1. Pump down the unit and turn A/C off.
2. Connect the manifold with hose
3. Close the Section line valve
4. Start the vacuum pump at discharge valve.
5. Measure the vacuum until the gauge reaches 29 inHg.
6. Close each manifold and quickly shut off the vacuum pump.
7. Wait 2 minutes, and check reading remaining at 29 inHg.
8. Disconnect Refrigerant manifold.
9. Turn on A/C Unit.

Am 3

A/C should be installed on long wall.

Wall should be of good strength,

thickness should not be less than 9 inches.

A/C should not be near at electrical ~~or~~ HT line or Electronic Device.

~~A/C~~ Direct sunlight should not be reached on A/C I D U.

ODU should be install at out side of the ~~for~~ building.
Proper distance should be maintained.



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School of HVAC&R

I Semester, 1st In-Sem. Examination

B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA. 1104

Time: 1 Hour

Course Name: Sheet Metal and Welding process

Max. Marks: 20

Instructions:

1. Attempt all Questions.
2. Each question of Section – A carries 01 marks.
3. Each question of Section – B carries 02 marks.
4. Each question of Section – C carries 03 marks.

Section – A

05X01 = 05 Marks

1. Which one of the following is the most required thing in welding?
 - A. Current
 - B. Pressure
 - C. Heat
 - D. Electrode
2. What is the code for MMA Welding?
 - A. 111
 - B. 142
 - C. 121
 - D. 141
3. Tensile strength of electrode E6013 is:
 - A. 430 Mpa
 - B. 470 Mpa
 - C. 520 Mpa
 - D. 490 Mpa
4. The gap between the electrode and the work piece should be about:
 - A. Electrode Diameter
 - B. Core wire Diameter
 - C. Electrode Diameter X 2
 - D. Core wire Diameter X 1.5



5. What type of current does a welding transformer supply?

- A. DC
- B. AC
- C. Both

Section – B

03X02 = 06 Marks

1. Give the classification of inspection procedure in weld seam and name three processes of each.
2. Name general tools found in sheet metal workshop.
3. What is protective equipment? Write the name of four protective equipment used in welding.

Section – C

03X03 = 09 Marks

1. Describe the designation of Mild steel electrode in MMA. Explain what do you by E 6013 And E 7018.
2. Draw a design of the MIG / MAG welding System.
3. State the purpose of following tools used in sheet metal workshop:
Steel rule, Snip and stake.





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School of HVAC&R

I Semester, 1stIn-Sem. Examination

B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA 1105

Time: 1 Hour

Course Name: RAC Electricals

Max. Marks: 20

- Instructions:**
1. Attempt all the questions.
 2. Try to be precise while answering the question.
 3. Each question of Section-A carries 01 marks.
 4. Each question of Section-B carries 02 marks.
 5. Each question of Section-C carries 03 marks.

Section – A

05X01 = 05 Marks

1. If the no. of electrons in the outermost orbit is more than four. The material is:
 - a. Conductor
 - b. Insulator
 - c. Semi-conductor
 - d. None of the above
2. If the no. of electrons in the outermost orbit is exactly equals to four. The material is:
 - a. Conductor
 - b. Insulator
 - c. Semi-conductor
 - d. None of the above
3. What is the unit of power?
 - a. Ampere
 - b. Volt
 - c. Watt
 - d. None
4. What is the unit of energy?
 - a. Volt
 - b. Kwh
 - c. Ampere
 - d. Ohm
5. If two resistors of each 2 Ohms are connected in series, what is the equivalent resistance?
 - a. 1 Ohm
 - b. 2 Ohm
 - c. 3 Ohm
 - d. 4 Ohm

Section – B

03X02 = 06 Marks

6. Define electric potential and its unit.
7. State and explain ohm's law with an example.
8. Define Electric current. How does electric current flow in the circuit?

Section – C

03X03 = 09 Marks

1. State and explain Kirchhoff's Law.
2. What are the characteristics of a parallel circuit.
3. Distinguish between conductor, Insulator and semi-conductor.



Registration No.:

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Answer Key

School of HVAC&R

I Semester, 1stIn-Sem. Examination

B. Voc. Program, Summer Semester (2018-19)

Course Code: HVA1105

Time: 1 Hour

Course Name: RAC Electrical

Max. Marks: 20

Section – A

05X01 = 05 Marks

1. If the no. of electrons in the outermost orbit is more than four. The material is P
Ans. Insulator
2. If the no. of electrons in the outermost orbit is exactly equals to four. The material is
Ans. Semi-Conductor
3. What is the unit of power?
Ans. Watt
4. What is the unit of energy?
Ans. Kwh
5. If two resistors of each 2 Ohms are connected in series, what is the equivalent resistance?
Ans. 4 Ohm

Section – B

03X02 = 06 Marks

6. Define electric potential and their unit.
Ans. An electric potential is the amount of work needed to move a unit of positive charge from a reference point to a specific point inside the field without producing an acceleration. Its unit is volt.
7. State and explain ohm's law with example.
Ans. Ohm's law states that the current through a conductor between two points is directly proportional to the voltage across the two points. For example, that we have a circuit with the potential.
8. Define Electric current. How does electric current flow in the circuit.
Ans. Electric current is defined as the rate of flow of negative charges of the conductor. In other words, the continuous flow of electrons in an electric circuit is called an electric current. The conducting material consists a large number of free electrons which move from one atom to the other at random.

Section – C

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03X03 = 09 Marks

1. State and explain Kirchoff's Law .

Ans. There are two statements of the law:

- The 1st Statement: for a given junction or node in a circuit, the sum of the currents entering equals the sum of the currents leaving. This law is a statement of charge conservation.
- The 2nd Statement or the loop rule: around any closed loop in a circuit, the sum of the potential differences across all elements is zero. This law is a statement of energy conservation, in that any charge that starts and ends up at the same point with the same velocity must have gained as much energy as it lost.

2. What are the characteristics of parallel circuit.

Ans. A parallel circuit has two or more paths for current to flow through. Voltage is the same across each component of the parallel circuit. The sum of the currents through each path is equal to the total current that flows from the source. In a parallel circuit, each device is placed in its own separate branch. The presence of branch lines means that there are multiple pathways by which charge can traverse the external circuit. Each charge passing through the loop of the external circuit will pass through a single resistor present in a single branch. When arriving at the branching location or node, a charge makes a choice as to which branch to travel through on its journey back to the low potential terminal.

3. Distinguish between conductor, Insulator and semi-conductor.

Ans. An electron can move provided that, whenever it leaves its site, it can find some free space elsewhere where it can go. A material with fully occupied holes is then an insulator.

A semiconductor is primarily an insulator at 0K. However, since the energy gap is lower compared to insulators the valence band is slightly thermally populated at room temperature, whereas the conduction band is slightly depopulated. Since electrical conduction is directly connected to the number of electrons in the "almost empty" conduction band and to the number of holes in the "almost fully occupied" valence band, it can be expected that the electrical conductivity of such an intrinsic semiconductor will be very small.

For a conductor, conduction bands and valence bands are not separated and there is therefore no energy gap. The conduction band is then partially occupied (even at low temperatures), resulting in a "high" electrical conductivity.



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School of HVAC Skill

1st Semester, 1st In-Sem. Examination

B. Voc. Program, Summer (2018-19)

HVA 1106

RAC Electronics and Instrumentation

Time: 1 Hour

Max. Marks: 20

Instruction:

1. Attempt all Questions.
2. Each question of Section – A carries 01 mark.
3. Each question of Section – B carries 02 marks.
4. Each question of Section – C carries 03 marks.

Section – A

05X01 = 05 Marks

1. The unit of conductance is:
 - a) Ohm,
 - b) mho
 - c) Farad,
 - d) kg
2. Inductor stores energy is:
 - a) $\frac{1}{2} CV^2$
 - b) $\frac{1}{2} Li^2$
 - c) $\frac{1}{2} KJ^2$,
 - d) $\frac{1}{2} Mi^2$
3. The unit of Capacitor is:
 - a) Farad,
 - b) Henry,
 - c) Ohm,
 - d) mho
4. The value of the ceramic capacitor 204 is:
 - a) 0.1nF,
 - b) 0.2 nF,
 - c) 0.02nF
 - d) 0.002nF
5. Active circuit element is:
 - a) Resistor,
 - b) Thermistor
 - c) Capacitor,
 - d) Transistor

Section – B

03X02 = 06 Marks

1. What do you mean by active and passive circuit elements? Give examples for each component.
2. $C_1, C_2, C_3, \dots, C_n$ are in series and parallel combination then what will be the resultant capacitance for both the cases?
3. Why Capacitor blocks DC and pass AC signals? Explain it.

Section – C

03X03 = 09 Marks

1. Differentiate between intrinsic and extrinsic semiconductors. Draw these semiconductors with proper band diagram inserting Fermi level.
2. What do mean by PN junction diode? Draw and explain the PN junction.
3. Calculate energy stored across the capacitor if voltage (V) applied through the Capacitor (C).

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School of HVAC Skill

1st Semester, 1st In-Sem. Examination

B. Voc. Program, Summer (2018-19)

Course Code: HVAE1006

Time: 1 Hour

Course Name: Basic Electronics for HVAC

Max. Marks: 20

Section – A

1. ii)
2. ii)
3. i).
4. iii)
5. iv)

Section – B

1. Active ckt elements are those which have the capabilities to amplify the signal such as Transistor, MOSFET etc. Passive circuit elements are those which can't amplify the signal such as Resistor, Capacitor and Inductor.
2. Series Combination $\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$ and parallel combination $C = C_1 + C_2 + C_3$
3. As the frequency of DC signal is zero so the infinite resistive effect due to Capacitor. Due to this, Capacitor blocks the DC but couple AC signal.
 $X_c = 1/\Omega c = 1/2\pi f C$, X_c is the capacitive reactance, f is the frequency of AC signal, C capacitor

Section – C

1. Pure and undoped semiconductor is termed as intrinsic semiconductor. Doped with impurity material is termed as extrinsic material
The band diagram of the intrinsic and extrinsic semiconductor is as follows:

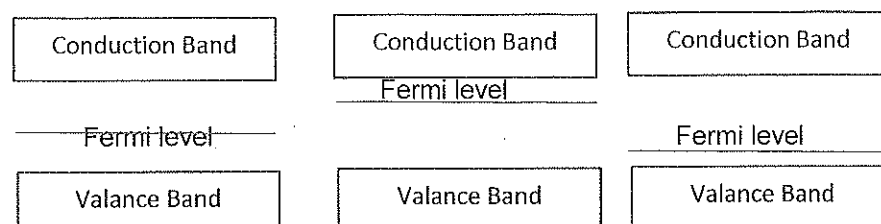


Fig 1: Intrinsic Semiconductor and Extrinsic semiconductor

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2. When semiconductor bar is doped one side by p-type dopant and other side n-type then this is termed as PN junction. When PN junction is used in electronic circuit for several purposes then it is called as diode. This circuit component has two terminals, so it is termed as diode.

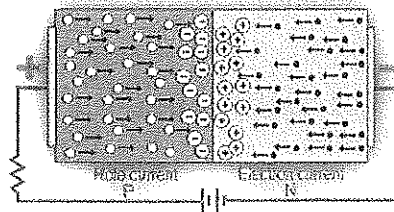


Fig.2 PN Junction diode

3. The stored energy of the capacitor is given as follows

The power generated due to capacitor is $(P) = IV = CV \frac{dV}{dt}$ [as $q = CV, I = \frac{dq}{dt}$]

Stored energy can be calculated as $(E) = \int_0^V CV \frac{dV}{dt} dt$
 $= \frac{1}{2} CV^2$