MAHAMAYA POLYTECHNIC OF IT HATHRAS
DEPARTMENT OF ELECTRONICS ENGG
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SUB : ENERGY CONSERVATION

Chapter 1 Basics of Energy

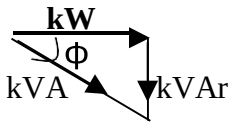
1.	The type of energy possessed by the charged capacitor is a) Kinetic energy b) Electrostatic c) Potential d) Magnetic
2.	The energy stored in the bonds of atoms and molecules is called a) Kinetic energy b) Chemical energy c) Potential energy d) Magnetic energy
3.	Active power consumption of motive drives AC 3 phase can be determined by using one of the following relations. a) $\sqrt{3} \times V \times I$ b) $\sqrt{3} \times V^2 \times I \times \cos\varphi$ c) $\sqrt{3} \times V \times I^2 \times \cos\varphi$ d) $\sqrt{3} \times V \times I \times \cos\varphi$
4.	The grade of energy can be classified as low, high, extra ordinary. In case of electrical energy it would fall under_____category. **(EM/EA)** a) low grade b) extra ordinary grade c) high grade d) none of the above
5.	The portion of apparent power that doesn't do any work is termed as a) Apparent power b) Active power c) Reactive Power d) None of the above
6.	Power factor (PF) is the ratio of **(EM/EA)** a) Apparent power & Active power b) Active power & Reactive power c) Active Power & Apparent power d) Apparent power & Reactive power
7.	kVA is also called as a) reactive power b) apparent power c) active power d) captive power
8.	The energy consumed by a 50 kW motor loaded at 40 kW over a period of 4 hours is a. 50 kWh b) 160 kWh c) 40 kWh d) 2000 kWh
9.	The ratio of maximum demand to the connected load is termed as a) Load factor b) Demand factor c) Contract demand d) none of the above
10.	A single phase induction motor is drawing 10 amps at 230 volts. If the operating power factor of the motor is 0.9, then the power drawn by the motor is a) 2.3 kW b) 3.58 kW c) 2.07 kW d) 2.70 kW
11.	The quantity of heat required to raise the temperature of 1 gram of water by 1 ^{0}C is termed as a) Specific heat b) Heat capacity c) One Calorie d) Sensible heat
12.	Nameplate kW or HP rating of a motor indicates a) input kW to the motor b) output kW of the motor c) minimum input kW to the motor d) maximum input kW to the motor

13.	The quantity of heat required to change 1 kg of the substance from liquid to vapor state without change of temperature is termed as a) Latent heat of fusion b) Latent heat of vaporization c) Heat capacity d) Sensible heat
14.	The latent heat of condensation of 1 kg of steam at 100 °C to form water at 100 °C, it gives out the heat of a) 580 kCal b) 540 kCal c) 620 kCal d) 2260 kCal
15.	The specific heat of_____is very high compared to other common substances listed below. a) Lead b) Mercury c) Water d) Alcohol
16.	The property of viscosity of liquid fuels: a) decreases with decreasing temperature b) increases with increasing temperature c) decreases with increasing temperature d)) None of the above
17.	The quantity of heat Q, supplied to a substance to increase its temperature depends upon the following. a) sensible heat added b) latent heat of fusion c) specific heat of the substance d) heat capacity
18.	Unit of specific heat in SI system is_____. a) joule /kg °C b) kg/cm^2 c) kcal/m^3 d) kcal/cm^2
19.	The change by which any substance is converted from a gaseous state to liquid state is termed as ----- a) condensation b) Evaporation c) Fusion d) Phase change
20.	The method of producing power by utilizing steam generated for process in the boiler is termed as ----- a) Extraction b) Cogeneration c) Both a & b d) Neither a nor b

Short Type Question and Answers

1.	Write a note on various forms of energy with examples. There are two types of energy-stored (potential) energy and working (kinetic) energy. Potential energy is stored energy and the energy of position. It exists in various forms. Eg: chemical energy, nuclear energy, stored mechanical energy, gravitational energy are different types of potential energy. Kinetic energy is energy in motion-the motion of waves, electrons, atoms, molecules and substances. It exists in various forms. Eg: radiant energy, thermal energy, motion, sound, electrical energy are various forms of kinetic energy.
2.	What are the various grades of energy with an example There are two grades of energy; namely high grade energy and low grade energy. Electrical and chemical energy are high grade energy, because the energy is concentrated in a small space. Eg: electricity used for melting of metals.

	Heat is low grade energy. Eg: Heat available from sun
3.	What are the characteristics of Direct current and Alternating current? Characteristics of Direct current are ➢ Direction of the flow of positive and negative charges does not change with time ➢ Direction of current is constant with time ➢ Potential difference between two points of the circuit does not change sign in time Characteristics of Alternating current are ➢ Direction of current reverses periodically in time ➢ Voltage between two points of the circuit changes sign periodically in time In 50 cycle AC, current reverses direction 100 times a second
4.	What is 'Reactive power' and 'Active power'? Reactive power (kVAr) is the portion of the apparent power that does no work. This type of power must be supplied to all types of magnetizing equipment, such as motors, transformers etc. larger the magnetizing requirement, larger the kVAr. Active power is the work producing part of the apparent power.
5.	What is power factor and how it is evaluated in the electrical system? Power factor is the ratio between the active power (kW) and apparent power (kVA). $Powerfactor = \frac{Activepower(kW)}{Apparentpower(kVA)}$ $Powerfactor = \frac{(kW)}{\sqrt{(kW)2 + (kVAr)2}}$
6.	Differentiate between 'contract demand' and 'maximum demand'? Contract demand is the amount of electric power that a customer demands from utility in a specified interval (Unit used is kVA or kW) while the maximum kW and or kVA requirement over a billing cycle is called as maximum demand.
7.	Define the term 'Load Factor' with an example? It is the ratio of average load to maximum load. In other words, it is the ratio of energy consumed during a given period of time to the maximum energy demand if maximum load is maintained through out that time period. For eg: the energy consumed by a plant during the day is 2000 kWh. The maximum load recorded during the day was 125 kW. The load factor for the above would be 2000/ (125 x 24) = 66.7%
8.	Explain the importance of TOD (time of the day) tariff? Many electrical utilities like to have flat demand curve to achieve high plant efficiency. They encourage user to draw more power during off-peak hours (say during night time) and less power during peak hours. As per their plan, they offer TOD Tariff, which may be incentives or disincentives. Energy meter will record peak and non-peak consumption separately by timer control. TOD tariff gives opportunity for the user to reduce their billing, as off peak hour tariff charged are quite low in comparison to peak hour tariff.

9.	Draw the vector diagram showing the relation between kW, kVA & kVAr and angle θ between kW and kVA. 
10.	A 45 kW motor is drawing 30 kW of power at a given point of time. Calculate the motor loading at full load if the efficiency of the motor is 90% Rated motor input power = 45/0.9 = 50 kW Actual power drawn = 30 kW % loading on the motor = 30/50 = 60%
11.	A 250 W sodium vapor lamp is installed on a street. The supply voltage for a street light is 230 V and it operates for around 12 hours in a day. Considering the current of 2 amps and power factor 0.85 calculate the energy consumption per day Energy consumption = V x I x Cos ǿ x no. of hours = 230 x 2 x 0.85 x 12 = 4692 Watt hours or 4.692 kWh
12.	A substance of mass 25 kgs @ 25^{0}C is heated to 75 ^{0}C. if the specific heat of the substance is 0.25 kCal/kg ^{0}C, calculate the quantity of heat added in the substance? Quantity of heat = m x Cp x ΔT = 25 x 0.25 x (75-25) = 312.5 kcal
13.	A three phase induction 75 kW motor operates at 55 kW. The measured voltage is 415 V, current is 80 amps. Calculate the power factor of the motor? Power consumption = $\sqrt{3}$ x V x I x Cos ǿ (55 x 1000) = $\sqrt{3}$ x 415 x 80 x Cos ǿ Power factor (Cos ǿ) = (55 x 1000)/($\sqrt{3}$ x 415 x 80) = 0.96
14.	Define the terms ‘temperature’ and ‘pressure’ Temperature and pressure are measures of the physical state of a substance. They are closely related to the energy contained in the substance. As a result, measurements of temperature and pressure provide a means of determining energy content. *Temperature* It is the degree of hotness or coldness measured on a definite scale. Heat is a form of energy; temperature, a measurement of its thermal effects. In other words, temperature is a means of determining sensible heat content of the substance *Pressure* It is the force per unit area applied to outside of a body. When we heat a gas in a confined

	space, we create a pressure increase, or more push. For example: heating the air inside a balloon will cause the balloon to stretch as the pressure increases.
15.	Differentiate the terms 'specific heat' and 'heat capacity'? Specific heat is defined as the quantity of heat required to raise the temperature of 1 kg of a substance through 1 ^{0}C. Heat capacity is defined as the quantity of heat required to raise the temperature of the object by 1 ^{0}C.
16.	Explain the terms fusion, melting point and vaporization of a substance? The change of state from the solid state to a liquid state is called fusion. The fixed temperature at which a solid changes into a liquid is called its melting point. The change of a state from a liquid state to a gas is called vaporization.
17.	Define 'latent heat of fusion' and 'latent heat of vaporization'? Latent heat of fusion (L) of a substance is the quantity of heat required to convert 1 kg of solid to liquid state without change of temperature. Latent heat of vaporization (L) of a substance is the quantity of heat required to change 1 kg of the substance from liquid to vapor state without change of temperature.
18.	What is 'calorific value' and how it is evaluated by using bomb calorie meter? Calorific value is energy content in an organic matter. It can be measured by burning it and measuring the heat released. This is done by placing a sample of known mass in a bomb calorimeter. A thermometer is placed inside and the increase in temperature after the sample is burnt completely is measured. From this data, energy content in the organic matter can be found out.
19.	What is 'thermal radiation' ? Give an example. Thermal radiation is a process in which energy is transferred by electro magnetic waves, similar to light waves. These waves may be both visible (light) and invisible. A very common example of thermal radiation is a heating element of a resistant heater.
20.	Define 'Law of conservation of matter'. Law of conservation of matter states that in any physical or chemical change, matter is neither created nor destroyed, but it may be changed from one form to another.

Long type questions and answers

1.	An industry is having contract demand of 1000 kVA. The minimum billing demand is 75% of the contract demand. The connected load of the plant is 2000 kVA. The recorded demand and power factor for the month of March 2003 is 1200 kVA and 0.8. The monthly consumption is 2.0 lakh units. The average load and maximum load of the industry is 700 kW and 900 kW respectively. Calculate 1. Minimum billing demand of the industry 2. Load factor of the plant 3. Demand factor of the plant 1. Minimum billing demand = 1000 x 0.75 = 750 kVA 2. Load Factor = Average Load / Maximum Load = 700/900 = 0.78 3. Demand factor = Maximum demand / Connected load = 1200/2000 = 0.60

2. The contract demand of plant is 1000 kVA. The minimum billing demand is 75% of the contract demand. The basic tariff structure is as follows:

Demand charges	:	Rs. 180 per kVA / month
Unit charges	:	Rs. 3.75 for the first one lakh units / month
		Rs. 3.50 above one lakh units / month
Fuel surcharge	:	Rs. 0.20 per unit / month
Service Tax	:	Rs. 0.25 per unit / month
Meter rent	:	Rs 500 / month

The energy consumption is 3,15,000 units and the maximum demand recorded is 600 kVA. Calculate the cost of monthly electricity consumption?

Demand charges	:	750 x 180	:	Rs. 1,35,000
Unit charges	:	100000 x 3.75	:	Rs. 3,75,000
	:	215000 x 3.50	:	Rs. 7,52,500
Fuel surcharge	:	315000 x 0.20	:	Rs. 63,000
Service Tax	:	315000 x 0.25	:	Rs. 78,750
Meter rent	:		:	Rs. 500
Total Cost	:			Rs. 14,04,750

3. What is heat transfer? Briefly explain three primary modes of heat transfer.

The rate of energy transfer is called heat transfer.

Heat is transferred by three primary modes:

- Conduction (Energy transfer in a solid)
- Convection (Energy transfer in a fluid)
- Radiation (Does not need a material to travel through)

Conduction

The conduction of heat takes places, when two bodies are in contact with one another. If one body is at a higher temperature than the other, the motion of the molecules in the hotter body will agitate the molecules at the point of contact in the cooler body and consequently result in increase in temperature.

Convection

The transfer of heat by convection involves the movement of a fluid such as a gas or liquid from the hot to the cold portion.

Thermal Radiation

Thermal radiation is a process in which energy is transferred by electromagnetic waves similar to light waves. These waves may be both visible (light) and invisible.

4.	What are the differences of AC current and DC current? The characteristics of AC current are o Direction of the current reverses periodically in time o Voltage between two points of the circuit changes sign periodically in time o In 50 cycle AC, current reverses direction 100 times a second (two times during one cycle) The characteristics of DC current are o Direction of the flow of positive and negative charges does not change with time o Direction of current is constant in time o Potential difference between two points of the circuit does not change sign in time
5.	Describe the merits of using steam in industries. Steam has been a popular mode of conveying energy, since the industrial revolution. The following characteristics of steam make it so popular and useful to the industry: • Highest specific heat and latent heat • Highest heat transfer coefficient • Easy to control and distribute • Cheap and inert Steam is used for generating power and also used in process industries, such as, sugar, paper, fertilizer, refineries, petrochemicals, chemical, food, synthetic fiber and textiles. In the process industries, the high pressure steam produced in the boiler, is first expanded in a steam turbine for generating power. The extraction or bleed from the turbine, which are generally at low pressure, are used for the process. This method of producing power, by the steam generated for process in the boiler, is called **"cogeneration."**