**Study Material**

**of**

**Hotel Engineering**

# B.Sc H &HA - Semester I



**Institute of Hotel management and catering Technology Kovalam, Thiruvananthapuram**

**Syllabus**

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**Contents**

**Hotel Engineering**

S.No **Topic Hours**

1. **Maintenance**  03
	1. Preventive and breakdown maintenance, comparisons
	2. Roll & Importance of maintenance department in the hotel industry with emphasis on its relation with other departments of the hotel.
	3. Organization chart of maintenance department, duties and responsibilites of maintenance department
2. **Fules used in Catering Industry**  04
	1. Types of fuel used in catering Industry; calorific value, comparative study of different fuels.
	2. Calculation of amount of fuel required and cost.
3. **Gas:**
	1. Heat terms and units; method of transfer
	2. LPG and its properties; principles of Bunsen and burner, precautions to be taken while handling gas; low and high-pressure burners, corresponding heat output.
	3. Gas bank, location, different types of manifolds.
4. **Electricity:**  06
	1. Fundamentals of electricity, insulators, conductors, current, potential difference resistance, power, energy concepts;definitions; their units and relationships, AC and DC; single phase and three phase and its importance on equipment specifications
	2. Electric circuits, open circuits and close circuits, symbols of circuit elements, series and parallel connections, short circuit, fuses; MCB, earthing, reason and placing switches on live wire side.
	3. Electric wires and types of wring
	4. Claculation of electric energy consumption of equipment, safety precaution to be observed while using electric appliances.
	5. Types of lighting, different lighting devices, Incandescent lamps,fluorescent lamps, other gas discharged lamps, illumination, and units of illumination. F .External lighting.

 G. Safety in handling electrical equipment.

1. **Water systems**  04
	1. Water distribution system in a hotel
	2. Cold water systems in India
	3. Hardness of water, water softening, base exchange method (Demosnstration)
	4. Water system swimming pools
	5. Flushing system , water taps, traps and closets.
2. **Refrigeration & Air-conditioning.**  10
	1. Basic principles, latent neat, boiling point and its dependence on pressure, vapour compressor system of refrigeration and refrigerants

**1**

* 1. Vapour absorption system, care and maintenance of refrigerators, defrosting, types of refrigerant units, their care and maintenance (Demonstration).
	2. Conditions for comfort, relative humidity, humidification, dehumififying, due point control, unit of air conditioning.
	3. Window type air conditioner, central air conditioning,preventive maintenance
	4. Vetrical trasportation, elevators, escalatros.
1. **Fire prevention and fire fighting system: 04**
	1. Classes of fire, methods of extinguishing fires (Demonstration)
	2. Fire exinguishes; portable and stationery
	3. Fire detectors and alarm
	4. Automatic fire detectors cum extinguishing devices
	5. Structural protection
	6. .Legal requirements
2. **Waste disposal and pollution control: 05**
	1. Solid and liquid waste, sullage and sewage, disposal of soild waste
	2. Sewage treatement
	3. Pollution related to hotel Industry
	4. Water pollution, sewage pollution
	5. Air pollution, noise pollution, thermal pollution
	6. .Legal Requirements
3. **Safety 01**
	1. Accident prevention
	2. Slips and talls
	3. Other safety topics
4. **Security 01**
5. **Equipment replacement policy: 05**
	1. Circumstances under which equipment are replaced B. Replacement policy of Items which gradually deteriorates
	2. Replacement when the average annual cost is minimum.
	3. Replacement when the present cost is minimum.
	4. Economic replacement cycle for suddenly failling equipment
6. **Audio visual equipments: 08**
	1. Various audio visual equipment used in hotel
	2. Care and cleaning of overhead projector, slide projector, LCD and power point presentation units. C. Maintenance of computers:
	3. Care and cleaning pf PC, CPU, Modem, UPS, Printer Laptops
	4. Sensors-Various sensors used in different locations of a hotel type, uses and cost effectiveness
7. **Contract maintenance:- 03**
	1. Necessity of contract maintenance, advantages and disadvantages of contract maintenance.
	2. of a contract types of contract, their comparative advantages anddisadvantages.
	3. Procedure for inviting and processing tenders negotlating and finalizing.

**2**

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| Institute of Hotel management & Catering Technology Kovalam, Trivandrum.Study Material of Hotel Engineering.**Chapter I****Maintenance****Definition:-Maintenance** is a combination of actios carried out to retain an item/ machine equipment/system/plant in order to restore it to an acceptable working condition.**The purpose of maintenance is to increase the system availability.**The term maintenance covers the following aspects:- a .Inspection of the item/plant/ equipment/machine/system.1. Repair of the defects if any.
2. Minor modification in order to reduce maintenance efforts.

The basic function of maintenance is to keep plant, machinery, equipment, system in a condition that will meet normal operating requirements.**Scope of Maintenance**In case of the hotel industry, maintenance of the following items/systems should be done:a. Land(Ground)- Lawn1. Site Development-Boundary wall, septic tank, storage Tank etc.
2. Buildings
3. Plants, Machinery, Equipments and systems
4. Water Supply System
5. Gas Distribution System
6. Fuel Supply Line System
7. Drainage System
8. Waste Disposal System
9. Pollution Control Equipments
10. Power Supply Equipments
11. Ventilation, Refrigeration and Air conditioning saystem
12. Fire fighting Eaquipments
13. Maintenance equipments and hand tools.
14. Laundry Equipments
15. Kitchen Equipments and Ranges
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| 1. Telephone system, Fax, Telex, Email.
2. TV Cable System Etc **Objectives of Hotel Maintenance**

These are :1. To achieve minimum breakdown and to keep the plant/machine in good working condition at the lowest possible cost.
2. Machines and other equipments should be kept in suich a condition which permits them to be used at their optimum (Profit making) capacity without any interruption or hindrance.
3. To ensure the availability of machines, buildings and services required by the customers.
4. To increase safety of guests/employees of hotel.
5. To maximize the availabilty and reliability of all of all the assets.
6. To obtain the maximum possible return on investment.
7. To extent the useful life of assets.
8. To ensure operation readiness of all equipments required for emergency use at all.
9. To increase operational stability of the systems.
10. To increase the operational efficiency of all facilities.
11. To increase customer satisfaction.
12. To save energy requirement expenditure

**Maintenance Action**: may include the following:-* 1. Inspection
	2. Measurement
	3. Servicing repair, removal, replacement, cleaning, lubrication,adjustement alignment, re-installation, modification, overhaul, rebuilding, reclamation etc.
	4. Disassembly, Assembly, checkout
	5. Securing material supply, storage of spares
	6. Preparation of report about maintenance
	7. Contingency items
	8. Administrative duties.

**Breakdown Maintenance**There are two main points to be made breakdown maintenance:-1. One is the heavy level of operator involvement. In order to fulfill the requirements operators which is becoming increasingly involved in breakdown maintenance, there must be a heavy training component. Operators must first be taught the first aid techniques over a period of time and more complex techniques of breakdown maintenance.
2. An insistance on permanently solving problems is the other side of breakdown

maintenance. This is an attitude that always asks the question. What needs to be |

**4**

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| done so this breakdown never occurs again? This is a major part of the philosophy that over a period of time equipment will get better.Activity of repair after breakdownA failed component or system is repaired and put back to an operating condition. Con-cerned with correcting the trouble or fault that might occur any during the functioning all equipment or machine. Such breakdown repair activities include dissembling of the equipment or machine its inspection, repair, replacement of parts, reassembling, test to make sure that equipment or machine again fully functional. Breakdown may be minor, major, complete stoppage of equipment/ do not cause work stoppae, reppairable ir-repairable oce.**Activities During Breakdown Maintenance :** areLocation of faultPrepare to dismantleDismantleClean the component Inspect wear, cracks, dents repair, replace, fit in componentLubricateAssemble**Preventive Maintenance**It concerns with preveting troubles before it occur, through well anticipated plans of checkups, repairs, replacements, top or major overhauls, cleaning, proper lubrication etc. of machines and equipments.The idea behind such maintenance is periodical time scheduled inspection of machines equipm,ent to detect wear and tear in them in advance of actual breakdown with planned worn out parts replacement, servicing, repairs etc soa to minimize the interference in the performance of the equipment and machines and at the same time it economieses maintenance expenses.**Features of Preventive Maintenenace:-**1. It is simple and flexible.
2. It can be adopted for any equipment.
3. It is a corrective measure.

**Policy of Preventive Maintenance:-**1. Regulation of activities
2. Direction regarding when and how to start activities.
3. Procedures
4. Resources.
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**5**

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| **Objectives of Preventive Maintenance:-**1. To find any condition that may cause machine/equipment failure before such breakdown occur.
2. To reduce expenditure in repairs.
3. To increase productivity through modification made during planned overhaul. **Acitivities of Preventive maintenance:-**
4. Inspection
5. To dis-assemble the component
6. To clean the component
7. To replace the component/repair the component
8. To lubricate the component

g. Assemble the compenent.**Advantages of Preventive Maintenance:-**1. Down time reudction
2. Operation loss reduction
3. Lower maintenance and operating cost
4. Lower overtime
5. Minimum inventory of spare parts
6. Lower operation pay.
7. Smooth Operation
8. Less manpower is needed
9. Minimum danger to life and surrounding machines
10. Better customer satisfaction
11. Greater safety to workers
12. Less damage to equipments
13. Better life of parts
14. Improved reliability and availability
15. Increased percentage utilization
16. Maximum return on capital investment.

**Disadvantages of Preventive Maintenance:-**1. Certain amount of breakdown/catastrophic failures occurs even when preventive maintenance is adopted.
2. No proir warning can be obtained from equipments.
3. Premature failures are there
4. We do not know future life of equipment, even though we go on repairing the equipment.

**Engineering MAintenance department of a hotel:-** |

**6**

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| The personnel and the equipments under their control provide the comfort demanded by the guests.The Maintenance department affect the operation of the other departments of the loging establishment.The care and operation of the physical plant is largely the responsibility of maintenance department.**Duties of Maintnance Persaonal:-**1. Inspection
2. Engineering

3 Maintenance1. Repair
2. Overhaul
3. Construction 7. Salvage

8. Clerical Jobs**Objectives of Maintenance Department are To**1. Protect the investment in the physical plant
2. Control the maintenance cost
3. Minimize the energy cost of the facilities
4. Minimize safety problems.
5. Supply and distribution of power, water etc.
6. Reduce down time.
7. Provide better services to customers.
8. Provide higher market value services.
9. Provide services at lower cost.
10. Provide timely services
11. Make life longer for equipments
12. Provide higher safety and morale for employees
13. Provide better environment for community
14. Provide smoother and continuous running of hotel.
15. Provide efficient waste disposal system
16. Ensure higher salvage value equipments.

**The functions of maintenance department are as follows:-****1.Preparation:**1. Maintenance request
2. Repair of equipment under breakdown
3. Assets/facilities register
4. Introduce check list to prevent breakdown
5. Maintenance schedule.
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**7**

1. Work/job specification
2. Programming annual & weekely planned maintenance programme.
3. Planned lubrication
4. Work Priority
5. Facitlity Priority
6. Safety

**2.Operation:**

Routine analysis, Layout and cost, work measurement, managing work loading.

**3.Progression:**

Critical analysis.

**8**

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| **Institute of Hotel Management & Catering****Technology****Kovalam, Trivandrum****Study Material of Hotel Engineering****Chpater II- Fuels****Chapter III-Gas****Chapter IV- Electricity**Fuels:-**Any source of heat energy is termed as fuel**The term fuel includes all combustible substances obtainable in bulk.Fuel is a substance which produce a large amount of heat when burnt with oxygen of atmospheric air.Fuels are primarily used for heating purposes.**Classification of fuels** a) **Solid fuels:-**Eg- coal, peat,lignite, wood, coke, Anthracite, Bituminous b) **Liquid fuels :-**Petrol, diesel, Kerosene, coal, tar, molasses, spirit, shale oil etc c) **Gaseous fuels:-**Methane, coal gas, produces gas, compressed blast furnace gas, turn gas, cock oven gas, water gas, compressed butane. d). **Electricity:-**Another classification of fuel1. Naturally occurring /primary fuels

Eg:- wood, peat, lignite, anthractite, oils, shale,petroleum1. Prpepared/secondary

(derived from primary fuels) eg:-charcoal, semi coke, coke, coal tan,spirit, kerosene, diesel, gasoline, producer gas, water gas, compared butane.**Good/Ideal fuel**1. low ignition point
2. has high calorific value
3. produces minimum quantity of smoke

d. should be easy to store and convenient for transportation and is ecnomic e) has moderate rate of combustion1. low content of non volastile material
2. produces no poisonous products on combustion

 h) is readily and plentiful available. |

**9**

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| **Terms related to Fuels** *Heat is a form of energy**ENergy in transition**It flows from hot body to cold body***Units of heat**1. **Calorie** :- The amount of heat required to raise the temperature of one gram of water through

 1 o C (15 0 160c)1. **Kilo Calorie**:- The amount of heat required to raise temperature 1 kg of water through 1 o C (15 o 16 o c)

 1 Kilocalorie= 1000 calories1. **British Thermal Heat Unit (B.T.H.U)**

The quantity of heat required to raise the temperature of 1 < b(pound) of water through1 of F (60 o to 61 0 F) iv) **Centigrade heat Unit (CHU)**The quanity of heat required to raisew the temperature of 1 B(pond) of water through 1 o C ( 15 o C to 16 o C)1 CHU = 453.6 Calorie = 0.4536 K cal.**Types of Heat**1. **Sensible heat**  is measured by the thermometer.

Amount of Sensible Heat = mass \*Specific heat\* rise in temeperature.1. **Latest heat**

The heat which changes the physical state of a substance without changing the tem perature.(3)**Latent heat of Fusion.**Heat required to melt ice from (0oC) 32 F to water at 320 F (0oC) =80 kcal/kgh1. **Latent heat of evaporation or vaporization:-**

Heat required to change water at 1000C (21 oF)=536kcal/kgh1. **Total heat of steam=Sensible heat+latentheat of vapurisation**

(=heat required to reach the boiling temperature 1000C+heat required to convert liquid water to steam at 1000C.Amount heat=mass x specific heat x rise in temperatureUnit:- J/Kg/degree CValue for water = 4.18\*103J/Kg/degree CGlass=0.5\*103/J/degree C iron=0.48\*103J/Kg/Degree C Copper=0.39\*103J/kg/Degree**Temperature**Degree of hotness or the level of heat intensity of a body is its Temperature Units of Temperature: |

**10**

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| **Degree Celsius:**Freezing point of water is taken as 00CBoiling point of water is taken as 1000CDivisions in between is divided into 100 equal divisons & each divison is 10 C**Fareint heat Scale**Freezing point of water is taken as 320F & Boiling point of water 2120F Conversion C/5=F-32/9**Ignition temperature**The temperature to which a comustible material must be raised to cause a rapid chemical union with oxygen.Values of Ignition temp.Coal 1500CMethane 7000C Hydrogen 5850C Petrol 3430C**Colorific Value of fuel****Tthe total quantity of heat liberated when a unit mass or a unit volume of a fuel is****burnt completely is calorific value fuel.**Name of Fuel Calorific value***Producer gas 12400 K Cal/m3***LPG 27800K Cal/m3Coal 8000 K/Cal kg Wood 4000 K/Cal/kg Oil 9000 K/Cal/kgPrpane 22250 K Cal/m3/11940K/Cal/KgButane 28840 K/Cal/kgDiesel 11000 K/Cal/kgCalorific Value of a Fuel are of following types.a. **Higher or gross calorific value.**The amount of heat evolved by the complete comustion of unit mass or volumeof the fuel when the produces of combustion are are cooled to the intital atmosphere temperature 150C.**Note:** This Calorific Valu is somewhat theoretical value as in many fuel application the heat carried by the water vapour is not condensed and is not available for producing work. |

**11**

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| b.**Lower or net calorific value.**The amount of heat evolved by the complete combustion of unit mass or volume of the fuel when the products of combustion are cooled to 1000C without condensation of steam.**Combustion**Is the chemical combination of a fuel with oxygen to give light and heat.Note; Slow combustion gives light and rapid comustion light & heat.Fuel + Air (Oxygen) Ignition Comustion rflease3s heat energyTypical Fuel consist 86% Carbon(C)12% Hydrogen2% Sulphur (S)Air Consists of 21 % Oxygen(O2)79% Nitrogen (N2) By WeightIdeal or Stochiometric Combustion Comustion Material Comustion ProductsCO2+H20 +SO2+N2 1 Kg Fuel + 14.1 Kg Air - 3.15Kg + 1.08 kg + 0.04kg + 10.83 kg[3.27 kg.02) (10.83 kg.N2] = 15.10 kgDuring Comustion process, carbon reacting with oxygen to form carbon dioxide (CO2) releasing heat energy to the tune of 8084 K Cal/kg of carbonUnder certain circumstances, carbon reacts with oxygen to form carbon monoxide (C0) which results in rleasing smaller quanitity of heat. (2430 k cal/kg of carbon and thus 5654 k cal of heat is lost.The heat released by the comustion is transferred to water to steam in the boiler in the boiler and to the therenic fluid in thermo-pac, the comustion products (flue gas) leave the boiler/ thermo-pac through the chimney, which also carries away certain quantity of heat with them.For Proper comustion the oil and air should be supplied at correct pressure, temperatureand in the correct quantity/ also the proper mixing of the fuel and air is essential **Excess air**In actual practice, sine mixing is never perfect, certain amount of excess air is needed for complete comustion and to ensure the release of the entire heat contained in fuel oilIf air is less, it would lead to incomplete comustion and smoke. |

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|  If air is too much, then surplue air will carry away heat in flue gases.Hence the optimum excess air level should be maintained for optimizing fuel usage.**Comustion Efficiency**(1) determining the combustion efficiencyIn ideal combustion, the flue gases contains carbon dioxide and sulphur-di- oxide together as 15.76% by volume and there is no oxygen in flue gases/ as excess air increases, the concentration of Co2 + SO 2 decreasesa and the concenteration of oxygen increses in the flue gases/ By measuring the content of Co2 or O2 in flue gases, we can find out the excess air in flue gases/ By measuring the temeperature of flue gases at the point of sample, we can know flue gas losses(stock losses) ii) Smoke also indicates combustion efficiency:-Black smoke indicates incomplete comustion + fuel wastage.White smoke indicates too much excess air + fuel wastageHazy brown smoke indicates proper combustion**Various types of fuels:**The following are types of fuels1) **Solid fuels** :- eg Dung, wood, peat, lignite or brown coal, bituminous coal, and anthratic are important natural solid fuels. Charcoal, soft coke, hard coke and carbonized lignite briqutters are the solid fuels derived from the natural varities Other examples of widely used solid fuels are animal dung and agricultural and industrial waste like straw, husk, coconut shells, bagasse, saw dust etc.Advantages of solid fuels Are1. they are easy to transport
2. they are convenient to store without any risk or spontaneous explosion 3) there cost of production is low cheap

 4) They posses moderate ignition temperature.**Disadvantages of solid fuels are**1. Their ash content is high
2. Their large proportion of heat is wasted during combustion . ie combustion efficiency is low.
3. Their burn with clinker form
4. Their combustion operation cannot be controlled easily.
5. Their cost of handlisng is high.
6. Their calorific value is lower, 4000 k cal/kg (wood).
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| 7) They require excess air for complete combustion.8)They are dirty9)large space is required for storage. 10)Require huge chimney for gases.**Examples.**1. Dung coke-calorific value 6 to 8 KJ/gm
2. Wood - on account of large amount of oxygen present, less than 1% of hydrogen is available for combustion and heat of combustion of wood is almost entirely due to the carbon which it is contained. When dry, wood is a good fuel but being lighter and more bulky than coal it burns in quicker rate. Ash content is low.
3. Peat-consists of fossils (water with) remains of vegetables matter generally mosses and aqueduct plants(growing in water) Calorific value is 3500 kcal/kg.

4.Coal: I s the product pof vegetbale matter which has, during the course of ages been Decomposed and solidified under under great pressure. The character of the coal depends on the length of time which has been occupied in its products and on the amount of pressure and heat to which it has been subjected in the strata of the earth. The coal is the best and the most suitable solid fuel which if it can be produced at a reasonable price.The Principal varities of coal are as follows;1. Lignite or Borwn coal: is intermedicate in appearence and properties between peat & true coal.I burns with a very long smoky flame and is generally non-caking. After drying in the air, lignite contains 15 - 20% of moisture. If thoroughly dried in a stove and again exposed to the air, it reabsorb the water which it lost during the drying. The composition of the lignite is 65% Carbon (C), 5% Hydrogen (H2), 22%Oxygen (O2), 1% Nitrogen (N2), 3.3%Ash. The specific gravity is from 1.2 to 1.3 Low grade fuel.
2. Bituminous coal: This is the lost commonly and widely used variety of solid fossil fuel. Theraw coal ordinarily sold in the market under the Hindi name ‘Koela’ belongs to this class. The sir dried moisture varies from 14 to 0.5%. The volatile varies from about 45% dow to about 20%, carbon from under 80% to about 92%. Hydrogen from 6 to 4% , Oxygen from 15 to 0.5% and calorific value from 8900 to 7500 KCal/Kg. KCal/Kg.
3. Anthracite: It burns without flame or smoke and with an intense local heat. but requires a strongdraught for its combustion. It is hard. brittle and most varities to crack by heat considerable when it is heated, especially when the heat is supplied suddenly. Specific gravity 1.35 to 1.7. Anthractities are characterised by low volatile matter, high carbon content. Composition: 91% Carbon, 3% Hydrogen, 2.5.Oxygen, 0.5%Nitrogen, 0.5% Sulphur, 2.5.Ash. Calorific value is equal to 8400 to 8700 KCal/Kg

**Artifical Solid Fuels:** |

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| 1. Briquette Fuel: It is usually made by mixing coldest or some other binding material and formed in to hard blocks of rectangular shape. Good Briquette fuel contain 7% of cash 3% of moisture in addition to the coal, Its Calorific value is about 8000 KCal/Kg.
2. Wood Charcoal: It is made by heating wood out of contact with atmosphere, or with only a limited supply of air to a temperature lower than 5500 F[287.80C], The higher the temperature the blacker and harder the charcoal produced. The yield of charcoal varies from 15 to 25% by weight of the wood from which it is produced. Dry charcoal contain 80 to 95% of carbon, 0.5 to 3% of Hydrogen, 1 to 5% of ash, the reminder being Nitrogen and combined Oxygen and Hydrogen. Calorific Value 7000 Kcal/Kg.
3. Peat charcoal: It is prepared from heat in the same manner as the wood charcoal is made from wood. Contains 80 to 95% Carbon and 10 to 15% ash.
4. Coke:It is solid carbonaceous material left after coal has been heated to a high temperature with a limited supply of air. The best coke for fuel is prepared from bituminous coal. It is hard, brittle and porous of a dark grey colour and slightly metallic luster. Composition 85 to 95% of carbon, 0.25 to 2% Sulphur and 4 to 6% ash. Exposed to the air it absorbs 10 to 20% moisture.

**2.Liquid fuels****Advantages o f liquid Fuels:**a .Low excess air is used1. It is possible to build high capacity plants for burning oils
2. Storage space is small.
3. Handling during transportation is easy. e Fuel do not deteriorate during storage. f. Change in load can be suitable met.

g. Ash and refuse are small, they burn without forming ash and clinker.h .Operation labour is less.1. System is neat and clean
2. They have higher Calorific value, 10500 kcal/kg for heavy fuel oil.
3. Their firing is easy.
4. Their flame can be controlled

m .Loss of heat to chimney is low.**Disadvatges of liquid Fuels:**1. Heat produced is costly.
2. Costly special storage tanks are needed.
3. Greater chances of fire hazards.
4. Bad odour
5. Burners-chocking is possible.
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**15**

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| **Types**A. Petroleum [IC Engine]:Composition Crude petroleum as it comes from the oil well usually contains 83 to 87% carbon, 11 to 14% Hydrogen together with small percentage of oxygen, nitrogen and sulphur, Specific gravity 0.8 to 0.95 Calorific value is about, 10800 kcal/kg. B. P{etrol or Gasoline:When the oil is subject to partial distillation at temperatures up to3000C, during this partiall distillation the light constituents 80oC .Boiling point is 33.3 to 1900C.Specific gravity is 0.74 Compostion is 85% Carbon, 14.6% Hydrogen. Higher Calo rific value is 12000kcal/kg.1. Neptha: Different grades of nephta comes of temperatures from 80 to 1500C.
2. Paraffin Oil or kerosene:Comes of at a temperature 150 to 2000 C Specific gravity is 0.79.

Composition is 863% Carbon.13.6% Hydrogen.1% Suplphur. Higher calorific value is 11000kcal/kg. Boiling point is 140 to 2800C1. Fuel oil: SPecific gravity is 0.88 to 0.94 Calorific value is 10100 to 10900kcal/kg. Benzol mixture obtained as a byproduct of cokeoven. I consists of aromatic like benezene, toluene, xytne.
2. Diesel Oil: Specific Gravity 0.87.Percentage composition 86.3% carbon, hydrogen 12.8%,

0.9% sulphur. Higher calorific value is 11000 kcal/kg. Boiling point is 182.2 to 2900C.1. Heavy fuel oil: Specific gravity 0.95. Composition 86% Carbon, 11.8% NHydrogen, 2% Sulphur, Higher Calorific value is 10500 kcal/kg. Boiling point is 2500 C. H .Shale Oil: It is suitable for boilers.

I. Furnace Oil: Calorific value 40800 Kj/KgJ .Ethenol: Calorific value 30 KJ/gm3.**GASEOUS FUELS**Advantages of Gaseous Fuels:1. Higher calorific value 27800 kcal/m3 for LPG
2. Lighted at moments notice.
3. Conveyed easily through pipes.
4. Burn without smoke, ashes etc.
5. Cleanliness in use.

**Disadvantages of gaseous fuels:**1. Very large storage tanks are needed.
2. Highly inflammable
3. Costly

Types:A.**Natural Gas:** It is produced as a result of the decomposition of organic matters in marshy lands and can be collected by steering up the bottom of stagnant pools. It consists if Methane. It is highly explosive. Calorific value is 10850 to 12500 kcal/m3. |

**16**

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| B. **Town or coal gas**: It is manufactured for heating or comusting in gas engine. It is obtained by distillation or carbonization of bituminous coal in closed retorts out of contact with air and is stored in gas cylinder under pressure after purification of gas.C.**Cokeoven gas**: It is manufactures as a product in the manufacture of coke by the high temperature carbonization of bituminous coking coal.D.**Producer gas**:It is manufactured in gas producer by the injection of air and steam in limited in a red hot bed of charcoal coke, anthracte containing the least volatile matter.E.**Blast Furnace gas**: It is manufactured in blast furnaces and is byproduct in the manufacture of pigiron from the iron are used in boilers.F.**Industrial Synthetic gas**: Low Calorific value 5300 kcal/m3G.**Water gas**: Higher calorific value 2800 kcal/m3H.**Biogas or Gobarages** : higher calorific value 5300 kcal/kg I. **Methane**: Higher Calorific value 3000 kcal/m3J. Butane : Calorific value 55 Kj/gm.K..**LPG** : Liquefied Petroleum Gases are usually classified as commercial butane, propane and butane propane and butane propane and butane propane mixtures. LPG marketed in India is a mixture of Propane and Butane. For identification of gas leakage, LPG is mixed with smelling gas, dehydrated desulphurished traces of organic sulphates. Byproduct of oil refinery during the cracking of heavy oil from well. 1.5 to 2 times heaver than air. For this reason. The Ground level of Kitchen should be ventilated at floor level.**Advantages of LPG:**1.High efficency and heating rate.2.Calorific Value = 2 X Natural Gas Calorific Value = 6 X Coal Gas Calorific Value3.Complete Combustion no smoke4.Needs little care5.Clean6.Flexible7.Portable8.Less Health Hazard9.CHeaper Than Gasoline10.Residue and oil contamination is small.**Disadvantages of LPG:**1.Faint odours.2.Leakage detection difficult.**Operation of LPG:**To Operate LPG Cylinder valve is first open and the lighted match/lighter is applied to the burn while appliance valve is opened simultaneously. The gas ignited at an instant and the flame can be adjusted by turning the knob. To extinguish the flame the knob is tuned off. When not in use the cylinder valve is |

**17**

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|  kept closed and this ensures safety. LPG can exist as gas at atmospheric pressure but can be readily liquified under pressure.**Figure of Gas Burner**The main body of burner is mixing tube and burner head. The mixture head carrier has a air shutter and an opening for the gas orifice. The horisontal pipe thrugh which the gas flows from the fuel line to the different orifices is called the manifold. Attaached to the manifold are burner valve handles which direct the gas through the orifices and mixture heads in to burner forced through the orifice at a velocity of 30 to 50 meter/second. The gas develops sufficeint suction to draw air through the partly opened shutter. Primary air mixes with the gas in the venture meter, gives a clean sharp flame. The gas air mixture flows through the ignition parts on the side of the burner head. Openings in the burner are drilled horizontally on the outer rim and vertical or at 450 angle in the centre. The inner parts heat the central portion of the utensil bottom frequently from the simmer section of the burner. Flame from the horizontal ports projects outward from 2.5 to 5cm, and it is then lifted upward against the utensil bottom. Flame failure device shall prevent gas from being supplied to the main burner. The pilot flame is established.**ELECTRICITY**Advantages of easily controllable, heat adjustment is very easy, no storage is needed, large amount is available.Disadvantage:- A gas burner can produce more heat per unit area an electric burner, Installation cost is higher.**FUEL COST**Fuel Cost= Quantity of fuel consumed x Rate [Cost per unit Qty) Fuel cost depends on:1. Size of the Kitchen, Kitchen ranges.
2. Type of the fuel
3. Level of maintenance of equipment
4. Efficency of the organization.

Total heat= Sensible heat + Latent heat of vapourisation Sensible heat = Mass x specific Heat x Rise in Temperature.**ELECTRICITY**Electric energy is variously utilized for lighting, transportation, communication, for operating electri furnaces, elevators and for driving various kinds of machine tools. |

**18**

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| In ancient Greek when amber (yellow brown gun that hardens into hard stone like material) is rubbed against a piece of silk cloth, it attracts light objects like small pieces of paper etc.This attracting property of amber was given the name of electricityThe name electricity is derived from the word electron which is the Greek name of amber.Modern Elctron TheoryAll matter whether solid, liquid or gaseous, consists of minute particles called molecules which are themselves made of still minute particles knows as atoms. Those substances whose molecules consists of similar atoms are know as elements and those whose molecules consist of dissimilar atoms are called compounds. An atom is taken to consist the following1. It has a hard central core known as nucleus. It contains 2 types of particles one is known as proton and carries positive charge, the other is neutron(discovered by chadvik in 1932) which is electricial neutral ie, it carries no charge through it is heavy as proton.

The protons and neutrons are very closely held together with tremendous nuclear forces.1. Revolving round the relatively massive nucleus, in more or less elliptical orbits (or Shells) are infinite similarly small particles known as electrons. THese electron carry the smallest negative charge and have a negligible mass.

The mass of an electron is approximately 1/1840 that of a proton. Such a view of an atom is known as Bohr-Rutherford Model.It has been found that an atom is like a miniature solar system, a heavypostitively charges nucleus taking the place of the sum at the centre with orbital electrons acting like planets. The planetary electrons revolve at distances which are much greater than the size of nucleus or electrrons themselves, hence most of the space occupied by an atm is empty.The + ve charge on a proton is numerically equal to the -ve charge of an election.Normally an atom is electrically neutral, because it consists of as many protons as electron. as electron. |
| The number of protons in the nucleus of an atom gives the atomic number(s) of the substance.The total weight of nucles (ie.protons + neutron) is called the atomic number (A)The simplest atom is that of the Hydrogen. It consists of one+ve proton and I orbital electron.Next is heliumThe electron is the outermost orbit experience a very weak force of attraction for 2 reason.a) force varies inversely as the square of the distance between 2 charge b) the presenceof a large number of elctrons in the intermediate orbits acts as a partial screen between the nucleus and the outermost electron.This screening or shielding action results in reduced attraction between the nucleus and electrons.In metals the outermost electrons are very loosely attached to the atom They very freely move from one atom to another.They wander about with random motion between atoms, continuously Colliding with one another but not moving in any particular direction.These are called free electron/electron gas.Eg.The conditions of these electron in a copper wire is shown in the fig.The atoms are arranged in a particular pattern called lattice. The signs indicate that they are charge truly (because of having lost some electrons) ie, they are now ions.Although these ions oscillate about their mean poision. Yet to the present they are shown as stationery.The electron shown as black dots with arrows. Wander about in all sorts of manner and directions. When this wire is joined across the terminals of a battery, the electrons experience an attractive force due to the anode and repulsive force duet to thecathode (-ve) with the result that they start drifting from cathode to anode as shown in fig (2) |

**20**

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| when some external force ( ie potential differences) is applied to these atoms, the outermost one or more electrons get easily detached from the parent atom and start drifting along and so give rise to flow of electrons.This continuous flow of electrons constitute an electric current.Note:- It is found that those substances whose atoms have their outermost orbits incomplete act as good conductors of electricity.ie, they permit an easy detachment of theior outermost electrons and offer very little hindrance to their flow through their atoms. Such substances are called good conductors.But substances whose electrons are rigidly held to their atoms are termed as bad conductors.In their case, a very large force(ie potential difference) is required to detach their electrons and even then the number of electrons detached and set drifting is comparatively small.**The idea/concept of electric potential**In fig(3) is shown a simple voltaic cell. It consists of a copper plate(known as anode) and Zinc rod (ie, cathode) immersed in dilute sulphuric acid(H2SO4) contained in suitable vessel.**The chemical action taking place within the cell causes the electrons to be removed from** cu.plate and to be depositied on the zinc rod. This transfer of electrons is accomplished through the agency of the diluted h2SO4 which is known as an electrrolyte.The result is that the zinc rod become-ve due to the deposition of electrons on it and the cu plate becomes +ve due to the departure of electrons from it.The large number of electrons collected on the zinc rod is being attracted by anode, but is prevented from returning to it by the force set up by the chemical reaction within the cell.But if the 2 electrodes are joined by a wire externally then electrons rush to the anode, thereby equalizing the charges of the 2 electrodes.However, due to continue of chemical reaction, a continues difference in the number of electron on the 2 electrodes is maintained which keep up a continues flow of current through the external circuit.The action of electric cell is similar to that of a water pump which, while working, maintains a continous flow of water ie water current through the pipe ( fig) |
| Note:- The direction of electronic current is from zinc to cu in the external circuit. However, the direction of conventional current( which is given by the direction of flow of +ve charge) is from cu to zinc.In the above case there is no flow of +ve charge as such from i electrode to another. But we can look upon the arrival of electrons on cu.plate(with subsequent decrease in its +ve) charge) as equivalent to an actual departure of +ve charge from it.Zinc, -vely charge is said to be -ve potential with respect to the electrolyte and the anode, +vely charged issid to be at +ve potential relative to the eletrolyteThis p.d is maintained by the chemical action going on in the cell..**Resistance**Is defined as the property of a substance due to which it opposes the flow of electricity (ie, electrons) through it.Metals (as a class), acids, salt solutions are good conductors of electricityThis is due to a larage number of free or loosely-attached in their atoms. These vagrantelectrons assume a directed motion on the application of a potential difference. These electrons while flowing pass through the molecules or atoms of the condductor collide with other atoms and electrons thereby producing heat.Those substance which offer relatevely greater difficulty or hindrance to the passage ofthese electrons are said to be relatively poor conductors of electricity like mica, glass, rubber, oils and dry wood etc.**Unit of Resistance**The practical unit of Resistance is Ohm(Ω)A conductor is said to have a resistance is of one Ohm if it permits one ampere current toflow through it when one volt is impressed across its terminals. For insulation whose resistaance is very high.**Laws of Resistance**The resistance R offered by a conductor depends on the following factors.a. it varies directly as its length b It varies inversely as its cross saection of the conductor. c. it depends n the nature of the materials. |

**22**

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|  d. It also depends on the temperature.Neglecting last factorR L/AOr R = PlaL=LengthA=area of cross section p=a constant depending on the nature of the material of the conductor and is known as the specific resistance or resistively.**Specific Resistance (resistivity)**Of a material is defined as the resistance the opposite faces of a meter cube of that materialUnit of ResistanceWe have P=AR/L=A meter2 x R ohm / L metere = AR/L ohm-metre.**Conductance (G) and conductivity(** σ **)**Conductance(G) is reciprocal of resistanceWhere as resistance of a conductor measures the opposition which it offers to the flow of current, the conductance measures the inducement which it offers to its flow.R=PL/AG=1/R=A/(p x L) = σA/LWHere is called the conductivity or specific conductance of a conductor.Unit is who (meter)The unit of conductance is mho(ie, ohm read backwards)**Effect of temperature on Resistance**The effect of rise in temp.is......a.to increase the resistance of pure metals/metals have a +ve temperature-coefficient andof resistance.b.To increase the reistance of alloysc.To decrease the resistance of electroytes, insulation(such as peper, rubber, glass, micaetc. ie has a -ve temp. co-efficient of resistance).**SAFETY PRECAUTIONS WHILE USING ELECTRICAL APPLIANCES:**Electrical accidents normally may be of three types. |

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| 1. Fire danger: Electrical short circuits can cause fire. The wiring need to be observed and tested time to time for leakage and hence short circuits. Electrical sparks may also be another cause of accruing fire. So, faulty wiring must be replaced as and when necessary.Fuse of correct rating to be used. Amperage of electric appliances to be noted and proper fuses fixed in circuit.Electric heaters are always to be used with guard over heater bars. Inflammable materials to be kept at safe place to avoid probable electric sparks nearby.2.Burns:When burns caused due electrical fire, first aid is of immediate necessity. First aid arrangements must be availble. Preferably trained personel also be there to deal with such situation.3.Shocks: Another very dangerous matter is electric shock. Short circuit or leakage of electricity in appliances or wires may be responisbile for it. Apart from being fatal, painful shocks may be felt at lower voltage down to 25 volts even.**ILLUMINATION****Production of Light:**The different methods of producing light by electricity may in a broad sense be divided into three groups:1)**By temperature incandesence.** In this method an electric current passed through afilament on thin wire placed in vacuum or an inert gas. The current generates enough heat to rise the temperature of the filament to luminosity.Incandescent tungsten filament lamps, are examples of this type. Since their output de-pends on the temperature of the filament they are known as temperature radiators.1. **By establishing and arch between to carbon electrodes**. The source of light in

their case is the incandescent electrode.1. **Discharge lamps-** In these lamps, gas or vapour is made luminous by an electric

discharge through them. The colour and intensity of light that is candle power emitted depends on the nature of the gas or vapour only. It should be prticularly noted that these discharge lamps are luminescent light lamps and do not depend on temperature for higher efficiencies. Examples:Mercury vapor lamp, Neon Gas lamp, fluorscent lamps, Sodium vapour lamps etc are examples of light sources based on discharge through gases and vapours. Discharge lamps can be further subdivided into two types.* 1. Those in which the colour of the light is the same as produced by the discharge through the gas or vapour. Examples are neon gas lamps, mercury vapour lamps and sodium vapour lamps.
	2. Those which use the phenomenon of fluorescence in their case the dis charge through the vapour produces invisible ultraviolet rays which cause flourescence in certain internally coated materials known as **Phosphors.**
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| **Candela (cd)** : It is unit of luminous intensity of a source. A light source has a luminous intensity of one candela if it emits one lumen (lm) per steradian**Steradian** is the unit of solid angle which is defined as the angle substended by a certain surface at a given point.**Practical Lighting Schemes:**For indoor illumination we have to consider not only the light received from direct source itself but also that refelected from walls and ceilings etc. Different lighting Schemes are classified as:1) **Direct lighting** : In this case light from the source falls directly n the surface or object to be illuminated. Most of the light is directed to the lower hemisphere with the help of shades, globes, and reflectors of various types. It is essential to keep the lamps and fittings clean otherwise decrease in effective illumination due to dirty bulbs or reflectors may amount to about 20 to 25% in offices and homes. This type of lighting is liable to cause glares and hard shadows. 2 .**Indirect lighting**: In this case light does not reach the working plane directly fromthe source but indirectly by defuse reflection. Lamps and tubes are placed either behind the cornice or in suspended opaque bowls. In this way, maximum light is thrown upwards on the ceiling from where it is distributed all over the room by defuse reflection. In indirect lighting provides shadowless illumination which is very suitable for drawing offices, composing rooms, and in work shops.1. **Semi direct lighting**: This system utilizes luminaries which sent most of the light downwards directly on the working plane though a considerable amount reaches the ceiling and walls also. Such a system is best suited to rooms with high ceiling where high level of uniformly distributed illumination desirable.
2. **Semi indirect lighting:** In this system light is partly received by defuse reflection and partly direct from the source.Instead of using opaque bowls

 withreflections trans lucent bowls without reflectorsw are used. Most of the light is therefore directed upwards plane directly except for some ab sorption by the bowl.1. **General defusing system**: In this system such luminaries are employed which have almost equal light distribution upward and downward.
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| **IHMCT****Study Material-Hotel Engineering Chapter 5****Water Supply System**Next to air, water is the other important requirement for human life to exist. It is the principal raw material for food production. It is needed for drinking, bathing, washing of hands, face, floors, washing of cloth, flushing of W/C, gardening, heating air, air conditioning, swimming pool, air cooler etc.**Sources of water**The chief sources of all water supplies are rainfall. This water after getting proper treatement we get from municipal cooperation/Water supply Department.Other sources of water are groundwater;water that has percolated into the ground is brought into the surface.A ground well is defined as an artifical hole/pit made in the ground for the purpose of tapping of water.**Types of Wells**1. Shallow Wells
2. Deep Wells
3. Tube Wells
4. Artisian Wells.

Tube well is a deep well having diameter of 50 to 200 mm.**Maintenance of Tube Well**1. Cleaning of screen with Hydrosulphuric acid, Hydrochloric acid.
2. Removal of lime particles-clogging of screen.
3. Replacement of parts.
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**26**

 **Wastage of Water**

**Prevention Methods:**

1. Design \_\_ Proper design of pipe network.
2. Fittings \_\_ By using standard pipe fittings
3. Inspection \_\_ By frequent inspection of pipe network. 4 Meters \_\_ Using standard quality meters.
4. Propaganda \_\_ Through papers and other mass media.
5. Service Connection \_\_ To be done by a licensed plumber
6. Tests \_\_ Water tests.

# Water Softening

Water which does not produce lather with soap solustion is called hard water.

**Disadvantages of Hard Water:**

1. If it is drunk, it leads to stone formation of calcus.
2. It leads to corrosion and incrustation of pipes and plumbing fixture.
3. It increases the fuel cost.
4. It makes the food tasteless.
5. During bathing lots of soap is washed.

The hardness of water is of two types:

##  1. Temporary / Carbonate harness

Due to the presence of Bicarbonates of Calcium and Magnesium. It can be removed by boiling or adding lime to the water.

##  2. Permanent Hardness

Due to the presence of sulphates, chlorides and nitrates of Calcium and Magne sium.

## Advantages of Soft Water

* Improves the taste of food.
* Increases the life of textiles.
* Personal washing and domestic cleaning becomes less boring.
* Less loss of heat in hot water pipes.

**27**

# Removal of Permanent Hardness

**Softening Methods:**

**1. Lime Soda Process:**- Slaked lime and sodium carbonate or Soda ash is used to remove hardness. The hadness is brought down to 3 to 4 degrees. Hard water is treated with slaked lime and soda ash in reaction tanks provided with stirrers. Most of the heavy precipitators settle down as sludge at the bottom of the tank and are removed from time to time. The softened water is then filtered.

 **2 Demineralization/deionization/UIron Exchange Process:**- The hard water

is passed through a bed of resin beads of carbonaceous material in the hydrogen form. Demineralized water does not contain any ion including hardness producing one.

**3. Zeolite./Permitite/Base Exchange Process:** - The zeolites are compunds of Aluminum, Silica and soda. They have got the excellent property of interchanging base. They release their water in the form of steam.

When hard water comes in contact with **Z**eolite, Calcium and Magnesium are removed and Sodium is given in exchange. After some time sodium present in **Z**eolite is exhausted. It is regenerated by passing a solution of salt through the **Z**eolite.

## Conveyance of Water

Water is conveyed through water pipe lines, containing water pipe and pipe joints.

**Water pipe material may be:**

* Asbestos cement • Cast iron
* Cement concrete
* Galvanized iron
* PVC
* Steel

**Water Distribution System**

1. Gravity system
2. Pumping System
3. Gravity & Pumping System

### 28

* Gravity System: - Useful when the source of water supply is situated at a higher level than that of distribution area. Water is coveyed through pipes by gravity.
* Pumping System : - Water is directly pumped to the mains leading to the consumers.

# Desalination

For making sea water suitable for drinking, disalination is done. Sea water is heated bysteam, operating under decreasing pressure. Vapour rising from the flushing action is used to preheat the incoming sea water feed and is then condensed into distilled water.

## Water Heaters

Directly fired: - Fires directly, Fuel sources- oil, coal, gas, LPG or electricity or solar energy. Geyser is used in every room for heating water in houses. The fuel is burned and the resulting heat is transferred to the water.

## Swimming Pools

A swimming pool is a pucca water tank with all sorts of facilities required for the purposes of swimming and diving. Adequate supply of water and filtration, chlorination and pumping arrangement should be ensured in swimming pool.

Drainage of overflow water and wash water from bath house should be made properly. The diving end has a greater ledge than the other end. The bed of the pool should have a gentle slope of 1 in 20, starting from the shallow end.

Four types of systems are used in purification of water in swimmig pools:

1. The action of emptying, cleaning and refilling of the pool are carried out at certain intervals.
2. Periodical addition of a disinfectant such as chlorine compound for water. Water is changed less frequently.
3. The continuous circulation of water through purification plant.
4. The pool is filled with pure water and the water is circulated continously by a pump during bathing hours.

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**29**

**INSTITUTE OF HOTEL MANAGEMENT AND CATERING TECHNOLOGY Kovalam**

### STUDY MATERIAL ON HOTEL ENGINEERING

#### Chapter -6

Refrigeration & Air conditioning

Refrigeration is the process of removal of heat from a body that is colder than its surroundings.

##### Types of Heat

1) Sensible heat:-heat is measured by a thermometer.

 Amount of sensible heat = mass\* specific heat\* rise in temperature of a substance Specific heat of a substance is the amount of heat required to raise the temperature of the unit mass of the substance through unit degree.

ii) Latent heat:- The heat which changes the physical state of a substance without changing its temperature.

1. Latent heat of fusion:- Heat required to melt ice from (00c) 320 f to water at 320f

(00c) =80k cal / kg

1. Latent heat of vapourisation or evaporation.

Heat required to change water at 1000 c(2120 F)=536 k cal /kg

1. Latent heat of condensation

Heat removed to convert vapour into liquid at the same temperature

Boiling point /dependence on pressure

Refigeration is accomplished by removing heat from the system. For example the

household refrigerator absorbs heat from the food products and releases this heat into the room where it is kept and thus a constant temperature is maintained inside the refrigerator cabinet.

The equipments employed to maintain the system at alower temperature is termed as refrigerating system and the system which is kept at lower temperature is called refrigerated system.

The working fluid used in a refrigerating system is known as refrigerant.

Refrigeration may be obtained by adopting either

1. Natural methods
2. Or artificial methods.

Natural mehtods include melting of ice (ice refrigeration)

###### 30

ice is put around the object or liquid which is to be cooled, separation is by wood or steel. In this heat is taken from object and the ice melts and gets converted to water. iv) second law of thermodynamics.

##### Clausius statement

A self acting machine working in a cycline process cannot transfer heat from a body at a lower temperature to a body at a higher temperature without the help of an external agency. ie. Heat cannot flow from a cold body to a hot body on its own.

Refrigeration effect

The rate of heat absorbed from the body or space to be cooled is the refrigerating effect.

##### Unit of refrigeration

The capacity of refrigeration unit is generally given in tones of refrigeration (TR)

One ton of refrigeration means one tonne of water at 0oc converted into one ton of ice at 0oc in 24 hrs.

1 ton refrigeration =3024 k cal /hr=3.517 kw.

##### Cofficient of performance

The performance of refrigerating system is measured by coefficient of performance.

COP - Heat removed in keal per unit time

Work supplied in keal per unit time

Methods of refrigeration.

Vapour refrigeration system in which vapours like amonnia, carbon dioxide, suphur dioxide, Freon etc are used as the working fluid.

##### Refrigerant:-

Any substance that aborbs heat through vapourisation, may be called a refreigerant

The two basic types of vapour refrigeration system are 1) Vapour compression system 2) Vapour absorption system.

**31**

##### Vapour compression system

In a vapour compression refrigerator, the working fluid is a vapour which reaadily evaporates and condenses.

During the evaporation process it absorbs heat and gets converted from liquid to

vapour. During the condensing process it rejects heat and gets converted from vapour to liquid.

Simple vapour compression System

A simple vapour compression system consists of the following basic components:

1. Compressor
2. condenser
3. Expansion value (Throttle value)
4. Evaportor

The line diagram of the arrangements shown in fig.. Let the vapour leaving the evaporator be dry saturated. This dry saturated vapour at pressure PI and temperature TI is compressed isentropically to pressure P2 and temperature. T2..This proc 3ess is shown by 1-2 in the diagram. At the end of compression the vapur is at superheated state. The vapour at this state passes to the condenser in which cooling water is circulated to remove heat from the vapour. The vapour is first cooled to the saturation temperature and on further removal of latent heat of condensation it condenses to liquid till point 3 is reached, this high pressure liquid is lowered to P1 and the condition obtained after this processes is shown by the point 4.During throttling the liquid partially evaporates and after throttling we get vapour at the low temperature T1 and low pressure P1. This wet vapour is then passed through the evaporate voils immersed in the brine solution. The wet refrigerant vapor absorbs latent heat of vapourisation from the brine solustion and evaporates. After evaporation the vapour reaches the condition given by point 1.ie, dry saturated at pressure P1. This completes one cycle of operation. The cold brine solution is then circulated in coils around the space to be cooled.

The net Refrigerating effect of this system is the heat absorbed by the refrigerant

from the brine solution. The work done by the compressor is the work input./ COP=Heat extracted in the brine solution/Work done by the Compressor.

###### 32



**33**

**IHMCT KOVALAM**

**STUDY MATERIAL OF HOTEL ENGG.**

#### CHAPTER 07 FIRE PREVENTION AND EIRE FIGHTING SYSTEM

FUEL +OXYGEN+HEAT=FIRE

Flash point is the lowest temperature at which the fuel gives off enough vapours that ignite for a moment when a small flame is brought near it.

Fire point is the lowest temperature at which the vapours of the fuel burn continuously for at least five seconds when a tiny flame is brought near it.

##### CLASSES OF FIRE

**CLASS A** fires include solid material, usually of organic matter such as wood, paper etc. They can be dealt with using water foam or multi purpose powder extinguishers, with water and foam considered the most suitable.

**CLASS B** fire involve liquids or liquefiable solids such as paints, oil,fats. It would be appropriate to provide extinguisher of foam, carbondioxide, halom or dry powder types.

**CLASS C** fire involving gases. Dry powder extinguishers may be used for these types. However you need to consider the circumstances for their use and combine this with action such as

stopping the leak to remove the risk of a subsequent explosion from the build up of unburnt gas.

**CLASS D** fires include metals. Specially trained personal with special equipment should tackle such fires.

**CLASS E** fires: Special extinguishers are available for use on fires involving cooking fats and oils,eg chip pans and fat driers.

TYPES OF FORTABLE FIRE EXTINGUISHERS.

The fire fighting extinguishing medium in portable fire extinguishers is expelled by internal pressure, either permenantely stored or by means of gas cartridge.

The different types are:

1. Water
2. Foam
3. Powder
4. Carbon dioxide and
5. Vaporizing liquids, including halons.

The most useful foam of fire fighting equipment for general fire risks is the water type extinguisher or hose race. One such extinguisher should be provided for every 200 sqmt. of floor space with a minimum of one per floor

**Foam types.**

Mechanical foam is obtained by passing foam producing liquid and water through an agitation device, foam is aggregate of air filled bubbles. Foams form a continuous blanket over the fire, depriving the flammable liquid from air supply.

**Cabondioxide type.**

The carbondioxide gas is filled under pressure. When the gas is released its non conducting internature displaces the air over and around the fire which will cease to burn when there is insufficient oxygen support combustion.

**Dry powder type.**

It fights fire by beating displacement of air and decomposition of dry powder effects. It is charged with a finely divided nonconducting non corrosive nontoxic water repellent powder which is expelled by compressed gas when the operating knob is struck.

**FIRE DETECTORS AND ALARMS**

Occupants are alerted by a number of different methods as traditional fire bells and sounders together with visual indicator such as ‘fire strobes’ in areas of high ambient noise.

Automatic fire detectors are meant to imitate one or more of the human senses of touch, smell or sight. Thermal detectors are similarly to our ability to identify high temperatures, smoke detectors replicate the sense of smell and flame detectors are electronic eyes.

The purpose of automatic fire detection system is the completely automatic detection of fire at the earliest moment once a fire is detected at its incipient stage alarms are generated within the premises and at the fire state. **Automatic fire detectotrs (sensors)**

**1.Thermal heat detector.**

Heat detectors can be electrical or mechanical. The most common type is thermo couples that senses ambient temperature and provide an alarm signal if the ambient temperature rises above the alarm threshod.

**Two types of heat detectors.**

1. **Fired or rate compensated**

These types of heat detectors react to a present temperature and will not activate until the present temperature is not reached, regardless of the rate of temperature increase.

1. **rate of rise detectors**

React ti sudden change or rise in ambient temperature from a normal base line condition. Any sudden temperature increase that matches the predetermined alarm criteria will cause an alarm

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Module-8

#### WASTE DISPOSAL & POLLUTION CONTROL

Introduction:

The hospitalty manager for developing an efficient waste management system in his establishment must be aware of various aspects as furnished below.

* Disposal fee is increasing at an exorbitant rate.
* Scarcity of land which leads to difficulty in waste disposal
* Public concern about environmental protection, Ecology etc.
* Enactment of laws and stringent standards by government and authorities.

Solid Wastes:

Solid wastes management program has the following components.

1. Collection
2. Transportation
3. Treatment
4. Disposal

A facility survey is the key to design and effective solid waste management syste3m. The survey must identify:

* Where the solid waste is generated: (House keeping, Food {Production Engineering etc)
* The quanity of wste generated daily, weekly and monthly
* Type of wastes being produced (food waste, Paper/Plastics, Equipment parts,Scraps etc)

Once the manager understands the source, Composition and quantity of waste generated, hecan design the most efficient and cost effective methods for collection, transportation and treatment/disposal.

**TRASH CHUTES:**

The location of the trash chutes is very importaant especially for high rise structures. They should be located centrally and shoyuld be easily accessible to carts. Carts can be used to collect and carry the wastes to the chutes. Many materials deposited in the trash chutes may be highly combustible. Hence to avoid any fire and untoward incidents regular cleaning and maintenance of chutes are to be arranged.

**TRANSPORTING WASTE:**

Motorized carts can speed up collection and transportation of solid wastes. These equipments also require regular maintenance. Employees are to be given training for proper operation of these equipments. the volume of the wastes colllected can be reduced to minimum through various methods like Pulping, Compacting, and Incineration.

**PULPING**: This is relatively a new technology for hospitality industry. Here the paper, paper boardfs, yard materials etc are converted to to a uniform semi dry pulp. This will help in reducing the volume of wastes.

##### **37**

**COMPACTORS;** The compactors accept raw waste and by the use of Hydraulic rams and

Plugers reduce the volume of waste mateerials as much as 80%. There are two types of Compactors; Stationary and self contained unit. For stationary type there is separate section for compaction and storage. Self contained units are used for compacting smaller quantity of solid wastes and here the compacting section and storage section cannot be separated.

**INCINERATORS;** Here wastes are burnt to ashes to reduce the volume. Small to medium size incinerators are available. Vplume of wastes can be reduced to 85 to 90%. If waste materials are in large quantity; incinerators can be equipped with heat recovery boilers for energy conservation.

**SOLID WASTE DISPOSAL :**

The following methods are mainly used for disposal of solid wastes:

 . Open dumping

 . Incineration

 . Compositing

 . Sanitary land fill

Open dumping is easy but not recommended as it is unscientific and causes nuisance to public and creates pollution and health hazards.

Incineration method comprises of burning the refuse in a controlled manner. Smoke treatment is required to control air pollution. Commonly used for disposing toxic waste.

Composting is biological decomposition of organic substances contained in the waste matter. The hy products are manures. By laying alternate layers of waste like night soil, animal dung, garbage etc composts can be made. Even small capacity equipments have been developed now for this purpose.

Sanitary Land fill method is the cheapest one. It is a modification of open dumping. wastes are deposited in different layers in depression ground and then compact and covered by earth.

#### POLLUTION

Introduction:

Nature has provided us the basic ingredients for comfortable living. What ever is used during normal course of living is recuperated trough nature cycle.

Waste matter & energy produced by human beings through their various activities cause destriction in the natural environment and in the eco system.

The public are now a days more concerned about environmental protection. governments have also enacted various laws for ensuring the protection of environment.

Hospitality sector which is the provider for comfortable and peaceful life for the guests are in a way more responsible for the pollution free environments.

Following are the harmful and hazardous discharges from hotel industry.

##### **38**

* CO2 Emission
* CFC Emission
* Noise, Smoke,Smells
* Energy waste, food wastes

Because of the above from hotels all sorts of pollution like water, sewage, air, noise, thermal etc can occur.

**AIR POLLUTION**: Air Pollution is acomplicated problem to hotel Industry to handle now days.

The major gaseous emission from a hotel is:

. Combustion products from the water boiler and HVAC system . Discharge from Kitchen and Laudry exhausts . Discharge from exhaust fans in public areas.

Hotel management has the responsibility to ensure that the environment inside and outside the property is free from any pollution so that the guests can have pure air inside and outside the hotel. In fact the quality of air inside the building is a combination of pollution from the air outside the building and the pollutants generated from sources or activities within the building.

Ventilation is required to:

 . Control the concentration of moisture/humidity

 . Dispose of surplus heat

 . Remove micro-organisms

 . Remove vapors, odors and smoke

Air Pollution can be controlled through the following methods

1. Smoke reduction/prevention during combustion of fuels by installing electrostatic precipitator
2. By installing filters. A fibrous medium acts as the separator and collection take place inside.
3. By installing cyclone separator-A cyclone collector is a structure in which the velocity of an inlet gas stream is transformed into a confined vortex and the centrifugal forces thus created drives the suspended particles to the wall of the cyclone body.

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##### **39**

4. By the use of settling chambers.



**WATER POLLUTION:** The hotel industry is dependent on large quantity of water. Various types of pollutiant cause much harm to the natural water making it non potable. The main sources of water pollution are:

1.1Sewage treatment

1. Catchments area wastes
2. Industrial wastes and effluents
3. Wild life watering
4. Radioactive wastes
5. Drainage from agriculture land
6. Runoff from land & fields.
7. Community water.
8. Swimming pools

Types of water Pollution are:

* Physical Pollution such as colour, taste, ordour, temperature, turbid ity etc
* Chemical pollution due to contamination by acids, alkalies, toxic compounds etc
* Biological caused by pathological organisms
* Radio active caused y radio active wastes,/materials

**SEWAGE DISPOSAL:** Normally swages of hotels are disposed to public sewage line. If the same is not available then the company has to go in for private sewage handling system.

There are four general types of private sewage disposal system

1. Cess pool and chemical toilets
2. Septic tank/Cess pool combinations
3. Septic tank and drain fields
4. Complete filter system

**NOISE POLLUTION**: Noise may be referred as unwanted sound. The unit used for measuring noise is decibel, Db. The effects of noise are:

* Noise annoys
* Noise distracts
* \Noise disturbs
* Creates uncomfortble living conditions • Reduction in productivity

##### **40**

* Effects blood pressure, muscular pain
* Leads to strain, Psycological reaction
* Leads to strain, Psycological reaction

Measuresto avoid noise will depend on the specific problem identified, but could include the following.

1. Determine day of week/time during which noise work can be carried out.
2. Determine maximum sound levels with in guest room for telephone bell Ring, TV sets accordingly

3 Set schedules and maximum sound levels for musical entertainments in public areas.

4. Consider relocation/elimination of disturbing night clubs and discos 5. Insist that ear protectors are worn by employees involved in noisy work.

6. Hotel Management can take steps like (a) Design of hotel building having better Acoustical properties (b) Install equipments having less noise during operation

THERMAL POLLUTION: Too high or low temperature are both harmful, So such thermal pollution can be tackled by proper design of hotels providing cross ventilation. If required artifical flow of air be managed using fans.

**SEWAGE POLLUTION:**

Sewage Pollution contaminates. Water, Ground, Land, and Air

Bactiria are harmful to man. Sewage is a growing place for bacteria

The hotel industry discharges grease, oil etc to sewage. Sewage is also blocked by plastic materials. By fitting control taps the flow of such materials to sewage lines can be prevented.

In our country Pollution control Act and Indian Factories. Act are the main legal enactment which stipulates necessary pollution control measures.

MODULES - 9 & 10

##### **41**

**SAFETY & SECURITY SAFETY:**

**Accident Prevention & Reaction:**

All hospitality firms have an obligation to keep their guests, patrons and employees safe and secure. Customers and guests may well avoid hospitality firms that have recently had serious accidents. Such accidents may generate negative publicity not only for the unit in which it took place but also for the whole chain.

There are two fundamental approaches to what might be termed as safety management.

They are:

* Prevention &
* Reaction

**Prevention:** This is obviously the intentional avoidance of accidents and this is the preferred strategy

**Reaction:** Even sound prevention system may not be able to avoid accidents in total. Hence it is necessary to be ready to handle situation after the happening of the accidents. This is reaction.

To have an effective strategy for accident prevention following are the steps that can be taken by the management.

1. Involvement of ali employees in the accident prevention programmes
2. To give adequate authority to employees to take action to avoid accidents
3. Success at accident prevention to be properly rewarded
4. Employees to be given proper and adequate training in accident prevention tech niques.

Approaches to safety challenges:

There are eight general approaches to safety challenges which are briefly discussed below:

1. Inspection
2. Preventive maintenance
3. Investigation 4. Policies
4. Construction
5. Equipments
6. Training
7. Contracting and assisting emergency service providers..

**Inspection** can be scheduled regularly so that dangerous conditions can be identified and immediate corrective measures can be taken.

**Preventive maintenance** will help to a large extent avoidance of possible accidents.

**Investigation** comes into play after the accident happened. Such investigation report will help to formulate policies and strategies for avoidance of recurrence of such happenings in future. **Policies** or rules that guide how to do the work can be formulated based on the investigation reports.

**Construction** of physical facilities can be done using methods and materials that will prevent accidents.

**Equipments** that will help detect or deal with emergency situation can be acquired by the management.

**Training** of employees can help them respond effectively to emergency situations.

**Contacting and assisting the emergency service providers** can make a great difference in the losses suffered because of accidents.

**SLIPS AND FALLS:**

Slips and falls generally are considered as minor accidents such as cuts, burns, and other injuries. But the damages or losses caused due to these minor accidents may be very heavy to the m anagement at times. The above mentioned eight approaches can be exercised in the case of slips and falls also.

**OTHER SAFETY TOPICS:**

**Prevention of diseases:** Prevention of disease transmission is an important aspects of hospitality safety. Prevention of infection in food service is accomplished in two general ways.

* Destroying bacteria or viruses through cooking, sanitizing and clean ing
* Preventing the growth of disease organisms by cooking, freezing, vacuum packing of drying.

**Natural Disaster:** The time and place of any particular natural disaster cannot be exactly predicted. Eg. Earth quake took place in Gujarat state.

T sunami of 2005

Possibility of occurrence of natural disasters is to be considered while deciding the location of a hospitality project.

**SECURITY.**

Security in hospitality business means protection against threats to guests, employees and to their properties posed by human beings with conscious intent to harm them, Management has to take into account the following aspects while focusing on the security.

* Restricted access: This has a psychological impact on a potential offender. Equipments like Alarms, CCTV etc canl detect un lawful intruders.
* Lighting: Aadequate lighting is a phychological deterrent to criminalactivity Mangement has to meet the stipulated standards with respect to illumination intensities.
* Parking : Parking facilities are to be monitored in order to minimize risks such as hit and run accidents, vandalism, auto theft etc. Adequate llighting to be proved at parking area and should be control of watch and ward personals.
* Doors, Locks and Windows: Management should consider the following basic guide lines.
	1. Solid core doors are to be provided for exterior openings.
	2. Hinges on all guest room doors are to be concealed
	3. Solid metal door frames are preferreds to hollow frames.
	4. Locks must be automatically engaged when doors are closed
	5. A peep hole can be provided to the guest room doors.
	6. Burglary resistant window glass must be used.
* Key Control: Locks are uselsess with out adequate key control. Keys are to be changed whenever key loss is reported or at least every eight months. A ket

 movementregister to be main tained properly and should beunder the safe custody of the supervisor.

* Valuables: Because problems can occur even with key control ghotel managers

 have to provide a safe or some other type of secure area for the protection of expensive property such as jewelry,Cameras etc.

MODULE: 11

# EQUIPMENT REPLACEMENT POLICY

In a hospitality property, there are different types of machines and equipments which are used to carry out different activities. Over a period of time these equipments may wear out, may become totally dysfunctional or may become obsolete on account of its continued use/technological development. This leads to the management to think of their replacement.

Replacement analysis means to decide whether the equipment is to be overhaulted or replaced.

Reason for replacement:

1.Inadequacy of equipment (insufficient)

2.Obsolesce of equipment old m/c against

 3 Declining efficiency

4. Hazardous working conditions danger works condition 5, More noise and vibrations 6. More accidents.

7. Automation needed 8. Less reliable..

11. Financial:

1. Repair expenses, labor cost etc increase
2. Power consumption increase
3. Less costly equipments are available.

Objective of replacement policy is maximization of profit of the business.

Factors influencing replacement policy :

* The existing machine works with less efficiency and requires expensive mainte nance.
* The machine may be failed completely or is expected to fail shortly
* A better or more efficient design of the machine is available in the market.

Types of failures:

* Graduate failures-progressive wearing of unit with time
* Sudden failures-The equipment fail suddenly after some period of using
* Failure without notice-eg,electric bulbs, circuit breaker, water cooler, furniture, bedding etc

**A. REPLACEMENT OF ITEM WHICH GRADUALLY DETERIORATE WITH TIME.**

Here the policy will be to replace when the yearly average cost of owning & operating the machine is minimum.

At the end of any period of time.

Total Cost of Equipment= Total C apital Cost+Total Operating Cost up to that time Average Cost/year=Total cost of equipment/Number of years. problem:

Machine A cost Rs. 9000/-, Annual operating cost is Rs.200/- for the first year and then increases by Rs.2000/- every year. In the fourth year operating cost becomes Rs.6200/- Determine the best age at which the machine can be replaced Assume that the machine has no resale value when replaced.

Solution

Replace at Running Total Loss due to Total cost Average cost the end of cost running cost reselling per yr.

1. 200 200 9000 9200 9200
2. 2200 2400 9000 11400 5700
3. 4200 6600 9000 15600 5200
4. 6200 12800 9000 21800 5450

The machine can be replaced at the end of third year when the average yearly cost of owning & operating the machine is Rs. 5200.

Problem- For a machine following data are given

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Year | 1  |  2  |  3  |  4  |  5 |  6  |  7 |
| Operating cost | 20000  |  24000 | 28000 | 36000  |  46000 | 56000  |  68000 |
| Resale value | 60000  |  30000 | 15000 |  7500  |  3500 |  -  |  - |

When the machine to be replaced?

Solution:

Year

Cumulative

Capital cost To

Total cost

Average

operating cost

cost/year

20000

80000

1

80000

60000

76000

134000

2

90000

44000

105000

177000

3

59000

72000

55125

220500

108000

4

112500

5

54000

116000

270000

154000

6

54334

326000

116000

210000

116000

56285

394000

7

278000

Replace the machine after 5 years because average annual cost is minimum at the end of 5th year.

**B.REPLACE WHEN THE PRESENT COST IS MINIMUM**

Present value=Original Value x Present Value factor (PVF)

Problem

Given below the date for two equipments. Find out which alternative you will select

.

|  |  |  |
| --- | --- | --- |
|  | Machine 1 | Machine 11 |
| Initial Cost | 5000/- | 7500/- |
| Annual Operating Cost | 500/- | 900/- |
| Salvage ValueLife =4years: Interest Rate 5%Solution:Equipment-1 | 500/- | 1500/- |
| Present cash flow as capital costPresent value of the operating cost@ 5s..500/-per year for 4 years |  | : 5000.00 |
| Present value of total cash out flow |  | : 500 x 3.546-1773.00 |
| Present value of salvage |  | : 5000+1773=6773 |
| Present value of net cash flowEquipment -11 |  | : 500 x .823=411 6773-411=6362/- |
| Present cash out flow as capital cost | : 7500.00 |
| Present value of cash out flow as operating | : |
| Expenses @400/-per year for 4 years | : 400 x 3,546=1418. |
| Present value of total cash out flow | : 7500 x 1418=8918/- |
| Present value of resale value | : 1500 x .823=1233/- |
| Net present value of cash flow | ; 8918-1233=7685 |

Since the present value of life cycle expense is less in the case of Equipment I it is suggested for purchase.

C. REPLACEMENT OF ITEM WHICH GRADUALLY DETERIORATE WITH TIME

Here the policy is to replace the item when the average annual cost is minimum

Total annual cost is (TA)-Capital cost + Maintenance cost-Scrape value Average cost per year = TA/N Where n- number years

Problem:

A machine A cost Rs.9000/- It has annual operating cost Rs 200/- for first year and then increase by 2000/- every year. In the fourth year operating cost is Rs.6200/-, Deetermine the best age to replace the machine. No resale value for the machine.

Solution :

Average cost per year can be worked out as below:

Year Running Cumulative Less due to Total cost Average cost cost runing cost selling per year

1. 200.00 200.00 9000.00 9200.00 9200/-
2. 2200.00 24.00.00 9000.00 11400.00 5700/-
3. 4200.00 6600.00 9000.00 15600.00 5200/-
4. 6200.00 12800.00 9000.00 21800.00 5450/-

Machine can be replaced at the end of 111rd year when the average yearly cost is minimum at Rs.

5200/-

**D. REPLACEMENT OF ITEM THAT FAILS ALL ON A SUDDEN**

Types of policies:

1.Individual replacement policy; Item is replaced immediately after its failure.

2. Group Replacement Policy:When the cost of labour is very high in relation to the cost ofitem to be replaced. The cost of labor includes the cost of preparation, removal, and installation and clean up man hours for replacing the item. If item fails permanently they will be replaced on a routine basis. If large number of items is purchased at one time, discount may be available.

Problem:

Following mortality rate has been observed for electric bulbs.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Week% at the end | 1 | 2 | 3 | 4 | 5 |
| Of the week | 10 | 25 | 50 | 80 | 100 |

There are 1000 bulbs. It costs Rs 12/- to replace an individual bulb which has burnt out. If all bulbs are replaced simultaneously ist would cost Rs.4/- per bulb. At what interval all bulbs be replaced.

## AUDIO VISUAL EQUIPMENTS

**Introduction:**

The application of Audio Visual Equipments in Hotel Industry is very vast. Some of the Audio Visual Equipments used in Hotels are :

Sound Projector

Slide Projector

Over head projector

Video Camera

Video Recorders

Screens

Spot light & stand

Cassette/Tape recorders and players

Micro phone/amplifiers

Cordless micro phone Power point equipment Computer etc.

**Slide cum film projector**: In this both slide and film strips can be used to project pictures related to topics, themes or subjects: The presenter need to give explanations

**Over head projector:** It is an improvement over slide and film projector. The advantages are:

Such projector contains an area of vertical projection besides straight horizontal one. **With the help of the mirror the path of the rays can be changed to horizontal one and the** images of the objects can be reflected on the screen or on the board. Another advantage is that it permits the presenter to use the board or screen for writing additional matters.

**Power Point Presentation Units** This is used along with a computer. The matter can be typed in computer and can be projected on the screen. The presenter can take the matter in CD or pen drive conveniently to the presentation place. Here also additional matter can be written on the white board while desplaying through the power point.

**Computers:**

Computer is an electronic device that accepts digital information (input) and process it in a predefined fashion, according to a set or sequence of instructions provided to it (ptocess it in a predefined fashion, according to a set or seqjence of instructions provided to it (process) and produce the desired results(outpur). computers are capable of storing large volume of data/.information for repeated use. The components of a computer can be classified as below:

**Input unit**: Input unit is used for entering the data into the computer for processing. Examples of input devices are:

Key board, Mouse, Documents readers, Touch pad, scanners etc

**Process:** Process is the systematic sequence of operation to produce the desired results. the central Processing Unit (CPU) takes care of the processing. In fact CPU can be called as the brain of the computer system. Main components of **CPU** are: Mother board. Hard disk. Arithamatical Logical Unit (SLU), Floppy disk, **CD ROM** etc.

**Out Put Unit:** The result obtained from the computer after processing data is called the out put.The main out put devices are: Monitor/Visual Display Unit (VDU), Printers. Out put can be seen in the monitor or its print can be taken using a printer. There are different types of printers now a days in use.

* Dot Matrix Printer-Speed is 300 characters per second  Line printers-speed is 150 to 2500 lines per minute.
* Ink jet printers-speed is 120 character per second
* Laser printers-These are high speed printers with 10000 lines perminute.

**Personal Computers** (PC): It is defined as a computer for general use by a single person **Desk Top:** This is PC which is not designed for portability and is expected to be kept in a permanent location.

**Lap Top**: This is also called note books. They are portable computers that integrate the key board (touch pad), VDU and hard disk all in a battery operated package.

UPS: UPS is the abbrevation of Uninterrupted Power Supply, a power supply that includes a battery to maintain power in the event of main supply failure. UPS can keep the computer running for several minutes/hours after a power failure enabling the user to save data and shut down the computer with out any problem.

UPS come in many different sizes and shapes. The size of the UPS is primarily dictated by the size of the battery; the larger the battery the more time the computer can run on battery supply. UPS systems of various capacities like 1 KVA, 2 KVA, 5 KVA/10 KVA and above are available taking into account the load to be sustained.

UPS Maintenance:

. The input supply to the UPS should be always switched on condition for charging the batteries

. Do not switch off the UPS when the computer is working. The sudden switching off may lead to the corruption of the files/data.

 . Do not connect appliances other than computer system to the UPS

 . Do not use the computer system when the UPS indicate battery low condition.

Care and Maintenance of Computers:

Proper maintenance of Comoputer is extremely important. It can keep the machine running efficiently and can forewarn of any hardware failures. Some of the tips are given below:

. \* Check the disk for errors

. \* Proper shut down of Windows

. \* Back up the data regularly

. \* Install and update antivirus program

. \* Cleaning the hard disk by removing unwanted files

. \* Empty the recycle bin periodically

. \* Check the clectric connection for missiong or loose links

. \* Keep a dust free atmosphere near the PCs and cover them properly after use

 . \*Avoid taking coffee/tea/snacks etc, while working on computer\* Key board v

 \* Key board andother computer surfaces to be cleaned using Vacuum cleaner and not using water or any liquid.

 . \* When not in use switch off the computer

 . \* Boot the system using power on key button(cold booting)

. \* Printers get heated up very fast since they are electro mechanical devices. Hence give them sufficient rest in between sessions.

 . \* Avoid using unauthorized soft wares.

. . \* Ensure Annual Maintenance contract (AMC) with computer vendor

### 49